

TECHNOLOGY DEPT

PUBLIC LIBRARY

SEP 3 1945

DETROIT

MODERN PLASTICS



SEPTEMBER 1945

✓R v.23' Sept. 1945-Feb. 1946



How To Select the Plastic That Fits Your Job

During the past five years the plastics industry has grown by leaps and bounds so that today you find plastics being used extensively throughout practically all fields of business. Because they are the most versatile the phenolics are the most widely used of all plastics. As specialists in the production of phenolics for the past quarter century, Durez makes the natural starting point for selecting the plastic that fits your job.

Typical of thousands of progressive concerns is National Fabricated Products—molders of the octal radio tube sockets illustrated. This company is well known for many outstanding contributions to the communications field and, like so many of America's manufacturers, has found the unusual versatility of Durez phenolic molding compounds of unusual value in developing complex products.

Octal Sockets

For example, these octal sockets were

molded from a high-dielectric Durez compound which provides a high-voltage breakdown safety factor as well as excellent tensile strength and low moisture absorption under humid operating conditions.

Designed to use a minimum amount of chassis space these octal sockets have self-aligning contacts which float in the molded Durez insulation and provide the necessary safeguards against fracture of the glass seal of the radio tube resulting from possible misalignment of tube pins. The exact tolerances and superb quality of the finished products attest the ingenious molding job done by National Fabricated Products and the versatility of the Durez phenolic molding compound used.

Unusually Versatile Material

Like the material used in molding these octal sockets, the more than 300 other Durez molding compounds possess

many highly desirable inherent characteristics which make them extremely valuable to the imaginative design engineer. Such properties as dielectric strength, excellent moldability, highest dimensional stability, and resistance to heat, moisture, and chemicals—to mention a few—are common denominators of all Durez compounds. make the logical starting point in the search for the plastic that fits your job.

Expert Assistance Available

The background of Durez technicians includes active participation in the successful development of many and varied products on a scope that is practically all-embracing.

The benefits which this experience and a wealth of proved product development data can provide are available to you and your custom molder towards helping select the plastic that fits your job. Durez Plastics & Chemicals, Inc., 269 Walck Road, N. Tonawanda, N.Y.



PHENOLIC
RESINS

MOLDING COMPOUNDS

INDUSTRIAL RESINS

OIL SOLUBLE RESINS

PLASTICS THAT FIT THE JOB

Feb

rent char-
extremely
design en-
dielectric
lity, high-
resistance
icals—to
on denom-
unds . . .
int in the
s your job.

Available

technicians
on in the
many and
that is prac-

rience and
develop-
available to
er towards
at fits your
icals, Inc.,
anda, N.Y.

POUNDS

RESINS

RESINS

THE GEM OF PLASTICS

Catalin

From its very beginning, Catalin was pure Color . . . rich, unrivalled, incomparable Color! This instantly distinguishable quality won Catalin a consumer acceptance that has steadily mounted to one of preference.

Apace with color, to commend it, Catalin's highly developed casting techniques, free of expensive mold costs and utterly flexible as to shape and design, have enabled manufacturers to advantageously launch new products—quickly and economically.

Exclusive to Catalin, is its ability to integrally cast multiple colors—for example—the two-tone handles shown above. These, manufactured by Schwarz Bros., Los Angeles, are proving highly successful on the west coast.

Many, many beautiful things have been done with Catalin—and in many, many fields—yet, the past is but a prologue! The future beckons much more brightly!

Desirous to serve, the members of Catalin's technical staff are readied now to direct their plastics know-how to your problems and plans. Inquiries cordially invited!

CATALIN CORPORATION • ONE PARK AVE., N. Y. 16, N. Y.
CAST RESINS • LIQUID RESINS • MOLDING COMPOUNDS

Modern Plastics AND PLASTICS

★ ★ ★

SEPTEMBER 1945

VOLUME 23

NUMBER 1

General Section

Rockets—and their plastic components	95
Resin-bonded pigment colors	100
Extrusion molding	103
Molded wrist watch straps	106
Plastics in review	108
Seeing . . . with and without light	110
Molding methyl methacrylate resins	112
Tattooing thermoplastics	118
Designs for light and lightness	119
More hand labor . . . not less	122
Plastics products	124
Fire bombs over Japan	126
Postforming and its application	129
Fitting materials to the part	132
Radio detection and ranging	132a
Radomes for the Black Widow	132H
Melamine trays for hospital use	188
Irrigation tubes and soil conservation	190

Plastics-Engineering Section

Molding for quantity and quality	133
Processing phenolic molding materials	140
Injection-compression molding of acrylic feeder heads	146

Technical Section

Variation of tensile strength and elongation of plastics with temperature	153
Wood aircraft assembly glues	156
Plastics digest	161
Technical briefs	163
U.S. plastics patents	166

News and Features

Books and booklets	168
New machinery and equipment	182
Washington round-up	184
News of the industry	186

CHARLES A. BRESKIN, *Editor and Publisher*
HARRIET B. JOSEPHS, *Assistant Publisher*
LAURA E. MORRISON, *Managing Editor*
DR. GORDON M. KLINE, *Technical Editor*
FRED B. STANLEY, *Engineering Editor*
ELLEN M. LYNN, *Associate Editor*
SHIRLEY SMARR, *Assistant Editor*
MARY H. WALKER, *Assistant Editor*
R. L. VAN BOSKIRK, *Washington Editor*
DONALD R. RUTHER, *Art Director*
F. M. TANENHAUS, *Readers' Service*

BUSINESS STAFF

ALAN S. COLE, *General Manager*
P. H. BACKSTROM M. A. OLSEN
DANIEL M. BROADS, *Director of Purchasing*
F. R. HARRIS, *Production*
WALTER S. ROSS, *Circulation Director*
J. M. CONNORS
221 N. La Salle St., Chicago 1, Ill.
R. C. BEGGS
815 Superior Ave., Cleveland 14, Ohio
L. B. CHAPPELL
427 West 5th St., Los Angeles 13, Calif.

All editorial contents bearing on military subjects have been released for publication by the Armed Services.

★

MODERN PLASTICS is regularly indexed in the Industrial Arts Index.

EXECUTIVE and EDITORIAL OFFICES:
122 E. 42nd St., New York 17, N. Y. WASHINGTON 6, D. C., OFFICE: 625 Colorado Bldg., 14th & G Sts. Published the 20th of the preceding month by Modern Plastics, Incorporated. Publication Office, Twentieth and Northampton Sts., Easton, Pa. Subscription price \$5.00 per year, \$8.00 for 2 years in U. S., its possessions and South America. Canadian subscriptions \$5.50 per year, \$9.00 for 2 years, all other countries \$6.00 per year, \$10.00 for 2 years, payable in American money or its equivalent. Price 50¢ per copy. Copyright 1945 by Modern Plastics, Inc. All rights reserved. Printed in U. S. A. Entered as second class matter, May 28, 1940, at the Post Office at Easton, Pa., under the act of March 3, 1879. Member of the Audit Bureau of Circulations. Back numbers 3 months or more preceding current issues, when available, \$1.00 each. Modern Plastics is fully protected by copyright and nothing that appears in it may be reprinted, wholly or in part, without special permission.



Member Audit Bureau of Circulations

WATER WINGS FOR A FLYING LIFEBOAT



Sails and all other fabric parts of rescue craft are protected by light-weight coatings of GEON

WHEN one of the newly developed Higgins air-borne lifeboats parachutes to the aid of downed fliers, a lot of GEON polyvinyl resin in the form of fabric coatings drops with it. Sails, sail covers, tarpaulins, water catchers—all are made from a GEON-coated fabric ("Duroduck", by Hudgins & Ratsey). Even the parachute packs and instrument cases are coated with this life-lengthening material.

That's because coatings of GEON offer such high resistance to normally destructive factors. For example, in the South Pacific area, an untreated fabric may be attacked by mildew and fall to pieces overnight. But mildew has no harmful effect on a coating of GEON. Nor does GEON suffer from the effects of sunlight,

air, heat, cold, salt water, abrasion—all of which are present in this unusual service.

In other fields, GEON may be made into products that resist oils, acids, foods, creasing, and flame. GEON raw materials may become a transparent packaging material that can be heat-sealed—or scuffproof luggage that will wear indefinitely—or shoe soles and heels that will last as long as the uppers—or upholstery material that can be left outdoors because it resists the action of sun and rain. All products of GEON may be delicately or brilliantly colored. There will be uses for products made from GEON in every industry. For more information please write Department II-9, B. F. Goodrich Chemical Company, Rose Bldg., Cleveland 15, Ohio.



B. F. Goodrich Chemical Company

A DIVISION OF
THE B. F. GOODRICH COMPANY



How to Keep a Signal . . . **"BUSY"**

"Land here!" "Patrol there!" "Base deflection—Right 321!" These are the "busy" signals of warfare. And it's the job of the Signal Corps to keep these vital communications crackling back and forth with a minimum of delay.

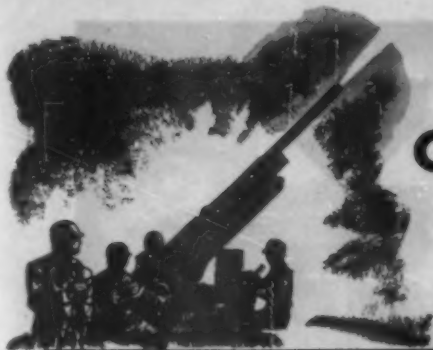
Their task is made easier because of the design and manufacturing skill behind the equipment in use today. Look at the receiver cases of **INSUROK**, molded to close tolerances by Richardson for the Rola Company, Inc., Cleveland, Ohio. These cases contain the delicate hearing mechanism of headsets made by Rola for use by our armed forces everywhere.

Notice the inserts, threads and holes in the cases illustrated. This is *precision molding*...all done in one operation...and is typical of the work we do daily with **INSUROK** for a wide variety of intricate industrial applications. If your product . . . present or planned . . . calls for the use of a moisture-resistant, light weight, dielectrically and mechanically strong plastic part—write Richardson Plasticians today for the full story about **INSUROK**—Molded and Laminated!

INSUROK *Precision Plastics*

The **RICHARDSON COMPANY**

MELROSE PARK, ILL. NEW BRUNSWICK, N. J. FOUNDED 1868 INDIANAPOLIS 1, IND. LOCKLAND, CINCINNATI 15, OHIO
DETROIT OFFICE: 6-252 G. M. BUILDING, DETROIT 2, MICHIGAN NEW YORK OFFICE: 75 WEST STREET, NEW YORK 6, N. Y.
CLEVELAND OFFICE: 326-7 PLYMOUTH BLDG., CLEVELAND 15, OHIO



HOW DETONATOR HOLDERS OF DU PONT "PLASTACELE"

*Make testing 5 times as fast . . . cut cost 11%
. . . halve weight . . . save metal*



THE OLD WAY: 2-part detonator holder of 90% copper, 10% tin. Unit cost: 9.9 cents. Weight: 8.5 grams. Since it was nontransparent and in 2 pieces, it required much more time to adjust the firing pin and detonator for test firing.



THE NEW WAY: Detonator holder molded of "Plastacele," all in one piece—increased production 1,500 holders per 8-hour shift. Unit cost: 8.75 cents—a saving of 11%. Weight 3.6 grams—a reduction of 57%. Transparency enables quick, accurate placement of firing pin and detonator. Molded by Boonton Molding Co., Boonton, N. J.

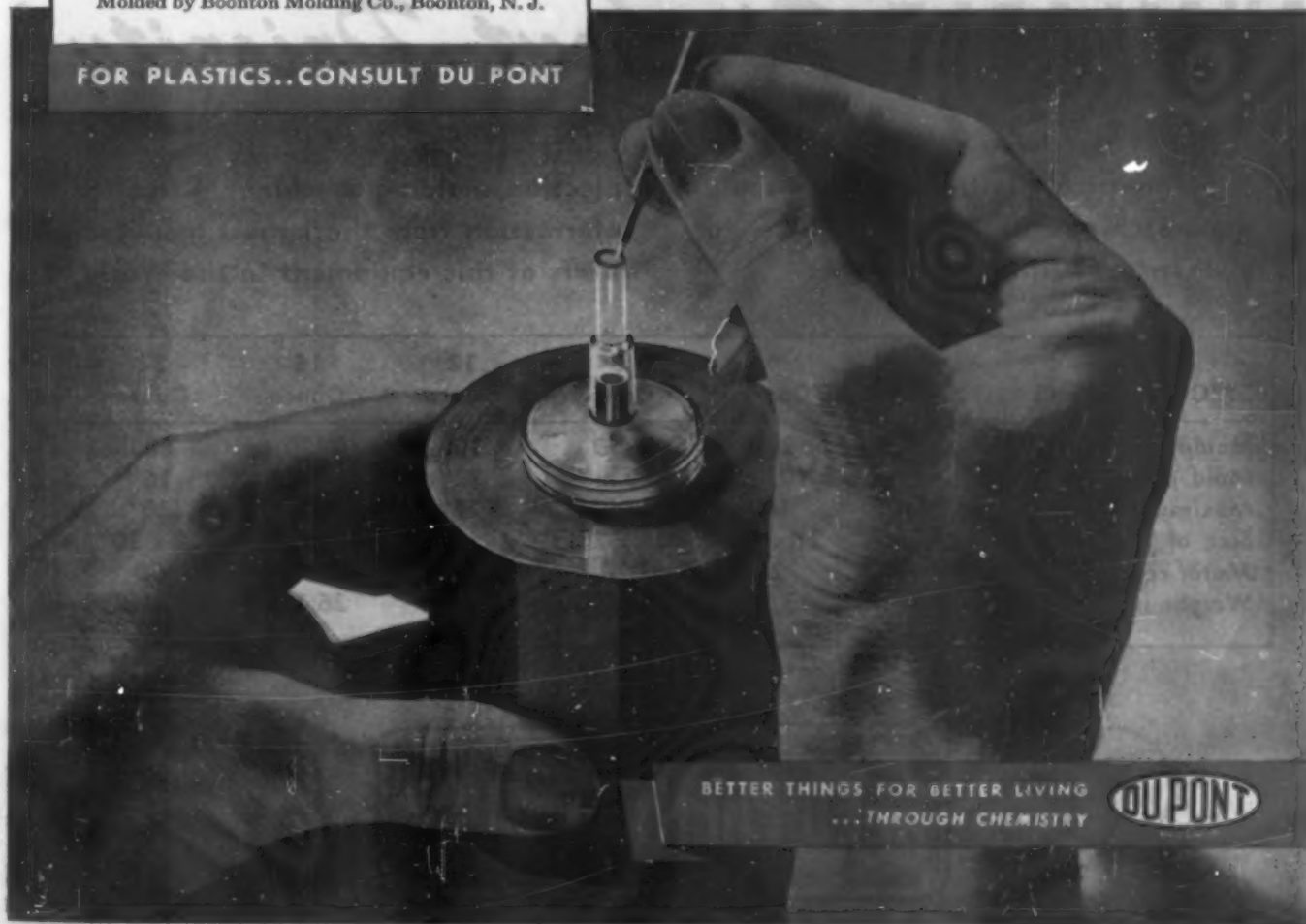
The arsenals of the Ordnance Department, U. S. Army, test their detonators with care. Tiny detonators (approximately $\frac{1}{4} \times \frac{3}{8}$ inch) furnish the initial explosion to the fuse in bombs, shells, rockets. If the detonator fails, the projectile is a "dud." Transparent detonator holders of "Plastacele" cellulose acetate plastic provide rapid and accurate testing. These sensitivity tests help make possible current proving-ground figures of less than 1% failure.

The men who make the firing tests say they now can fire 5 shots with the holders of "Plastacele" in the time it formerly took to fire one. Through the transparent plastic, they can see what they're doing. Also, they don't lose time in cleaning corrosion from the base after firing, as they did with the former material. Since each holder is used only once, and millions are used, the cost saving of 1.15 cents each is important. Important too is the saving of much critical metal.

For information or experimental quantities of "Plastacele" or other Du Pont plastics, write: E. I. du Pont de Nemours & Co. (Inc.), Plastics Department, Arlington, N. J.

ALWAYS THE BEST BUY—WAR BONDS

FOR PLASTICS..CONSULT DU PONT

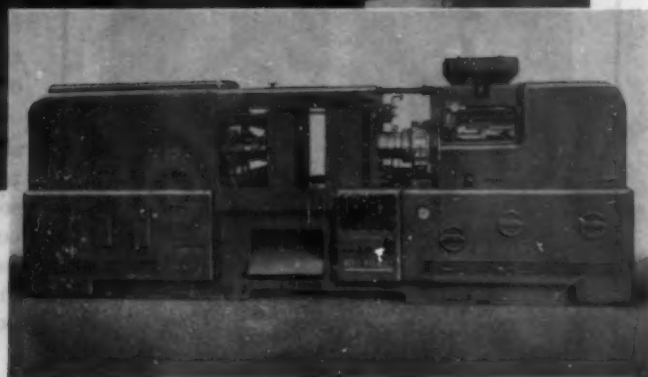


BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY





Reed-Prentice 6 and 8 Oz. plastic injection molding machine.



Reed-Prentice 12, 16 and 22 Oz. plastic injection molding machine.

AVAILABLE *Without Priority!*

Formerly restricted entirely to war use, Reed-Prentice plastic injection molding machines are now available for civilian use without priority.

If interested in 6, 8, 12, 16 or 22 Oz. injection molding machines, write for information from the largest manufacturers of this equipment in the World.

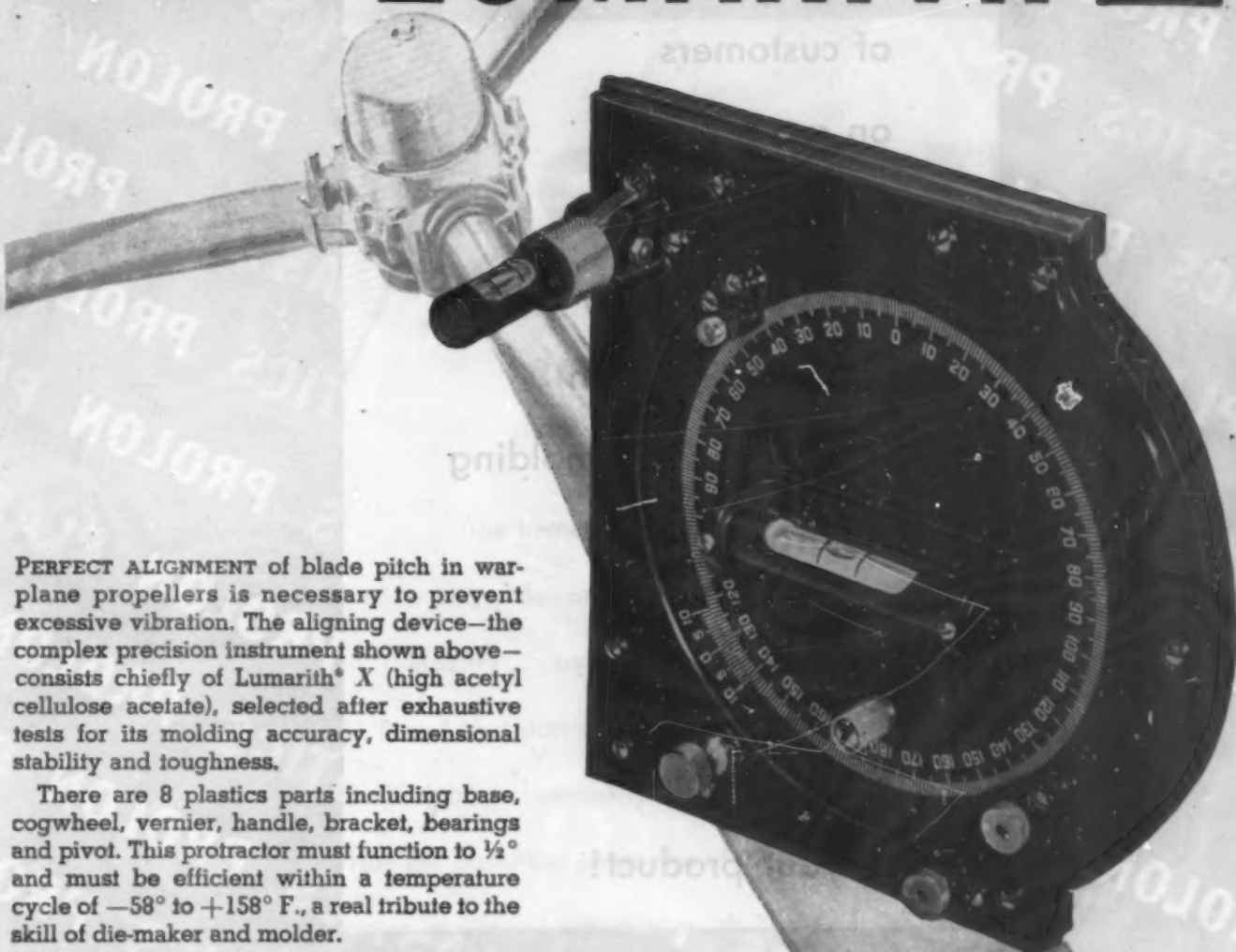
SPECIFICATIONS	6 Ounce	8 Ounce	12 Ounce	16 Ounce	22 Ounce
Molding pressure — tons	250	250	300	400	600
Mold opens —	10 1/4"	10 1/4"	12"	16"	16"
Maximum die space —	16"	16"	17"	20"	20"
Size of die plates —	21 x 25"	21 x 25"	25 x 26"	30 x 30"	30 x 30"
Motor required, 1200 RPM-HP	20	20	30	50	50
Weight in lbs. —	13,200	13,400	20,000	26,100	29,100



NEW YORK OFFICE: 75 West St., New York 6, N. Y.

CLEVELAND OFFICE: 1213 W. 3rd St., Cleveland 13, Ohio

This precision protractor
CHECKS TOLERANCES TO $\frac{1}{2}^\circ$!
AND IT'S MOLDED OF LUMARITH^{*} X



PERFECT ALIGNMENT of blade pitch in war-plane propellers is necessary to prevent excessive vibration. The aligning device—the complex precision instrument shown above—consists chiefly of Lumarith^{*} X (high acetyl cellulose acetate), selected after exhaustive tests for its molding accuracy, dimensional stability and toughness.

There are 8 plastics parts including base, cogwheel, vernier, handle, bracket, bearings and pivot. This protractor must function to $\frac{1}{2}^\circ$ and must be efficient within a temperature cycle of -58° to $+158^\circ$ F., a real tribute to the skill of die-maker and molder.

This kind of performance explains why Lumarith plastics are such favorites with fabricators. The wide range and scope of formulations not only assure materials individualized to the exact characteristics desired for end use, but also for precise dimensional control in molding and machining.

What are your war production problems in plastics? Consult the Sales Development Department of Celanese Plastics Corporation, a division of Celanese Corporation of America, 180 Madison Avenue, New York 16, N. Y.

*Reg. U. S. Pat. Off.

Dropped 60 feet to a concrete floor this Lumarith X propeller protractor was still workable although the metal frame had broken. Note that calibrations are molded in, not cut.

Molded by Cruver Mfg. Co., Chicago, Ill.

A Celanese^{} Plastic.*

VARIETY'S THE SPICE

Long and happy
experience,
with a variety
of customers
on a variety
of products
can pay off for you!
Whether injection
or compression molding
in large or small
pieces,
our experience
can add spice
to your product!

HAVE YOU A PLASTICS PROBLEM?

PROLON PLASTICS

FOR TOMORROW'S **BUILDING BOOM**

LET

TESTING

RATE THE ACOUSTICAL PROPERTIES OF YOUR PLASTIC INSULATION BOARD

The tremendous building program planned for tomorrow will make heavy demands for all types of insulating board. New to the building industry . . . unfamiliar to architects and contractors . . . Plastic Insulation Board must start from scratch in dramatizing its specifications . . . in selling itself. ★ In our completely equipped sound-proof laboratory we are prepared to rate the acoustical properties of Plastic Insulating Board on a basis of sound absorption and sound transmission. ★ Backed by these scientific ratings, you can speed the acceptance of your Plastic Insulation Board by the entire building industry. Write for complete information.



UNITED STATES TESTING COMPANY, INC.

ESTABLISHED 1880

HOBOKEN, NEW JERSEY

PHILADELPHIA, PA. • BOSTON, MASS. • WOODSOCKET, N. J. • CHICAGO, ILL. • NEW YORK, N. Y.

Aico
PRECISION MOLDED
FOR ACCURACY

24th



PLASTIC CONTACT BLOCK *for Oil Immersed Circuit Breaker Station*

BREAKING electrical circuits under oil is an essential precaution in chemical plants or other locations where inflammable materials and fumes increase the danger of fire from sparks.

The Aico-molded plastic contact block shown above gives top-notch performance in an oil immersed push button circuit breaker station made by the

Monitor Controller Company.

In this, as in many other applications—both simple and complex—the answers to chemical, physical and functional requirements are found in plastics. And, the solutions to design and molding problems which may arise are found in Aico's 29-year background of technical knowledge and molding skills.

CONTACT BLOCK molded from 120 Bakelite
for oil immersed circuit breaker station



120 BAKELITE
CONTACT
BLOCK

MOLDING MATERIAL

For economical molding of the part, and for good functional performance, the plastic material used to produce this contact block must combine good machinability with satisfactory electrical properties and resistance to oils. These qualities were the chief factors in the selection of 120 Bakelite.

MOLD DESIGN

For successful operation as a relay, the circuit breaker assembly necessitates close tolerances. Precision molds were required to maintain these tolerances in production of the contact block. This part is produced in a single cavity compression mold. Four molded-in countersunk holes (A), in the flange (B), are designed for mounting. These holes must be accurately placed, in relation to each other and to the top surface of the flange. The slots extend in depth beyond the molded-in slots (C). The small holes (D) are drilled through centers of bosses (E & F) to connect with the slots (C). Ends of large bosses (E) fit against a plate in main assembly. For this reason, close tolerances must be maintained in distance (G) from centers of countersunk mounting holes to ends of large bosses. Note also the slight depressions (H) on sides of large bosses (E).

*This is No. 24 in Aico's plastics applications series. For file cards Nos. 1 to 24, send a request on your letterhead.

Aico

PRECISION MOLDING

29th Year

AMERICAN INSULATOR CORPORATION

NEW FREEDOM, PA. Sales Offices: Boston • Bridgeport • Cleveland
Detroit • New York • Philadelphia

I. S. R.*

Brings Precision Control of Fiber Forms

TO MINERAL WOOL INDUSTRY



* Interlake
Specification Resin

A stream of molten glass, rock, or slag, at 2000° F., is hit by a jet of steam—blasted into extremely slender fibers. That is how mineral wool is made.

Those intensely hot fibers, while moving with high velocity in the steam jet, must be coated with a binder that the heat will not decompose, and which will impart to those fibers the degree of cohesion required in each of various types of fiber forms.

* * * * *

SINCE MINERAL WOOL "blowing" was originated in 1900, many binders have been tried—first starch, then asphalt, and then resins. But not until a *Specification Resin* was

developed (by Interlake) for one leading manufacturer, was it possible to *economically control* the resili-

ence or rigidity of mineral wool products.

Thus the bats, blankets, sawable boards, curved pipe coverings, etc., of mineral wool or glass fibers made by manufacturers using this Interlake specification resin have been given their present improved structural qualities.

IF YOU HAVE A RESIN PROBLEM, draw on the wide experience of Interlake. We will work with you on any resin problem, or discuss with you the possible advantage of using resin in any operation or process. Write Interlake Chemical Corporation, Plastics Division, 1911 Union Commerce Bldg., Cleveland 14, Ohio.

Interlake Production-Stabilized Resins have been developed to precise requirements of many specific applications in coating, impregnating, and bonding of...

WOOD • PAPER • METAL • GLASS
FIBER • RUBBER • CELLULOSE

INTERLAKE CHEMICAL

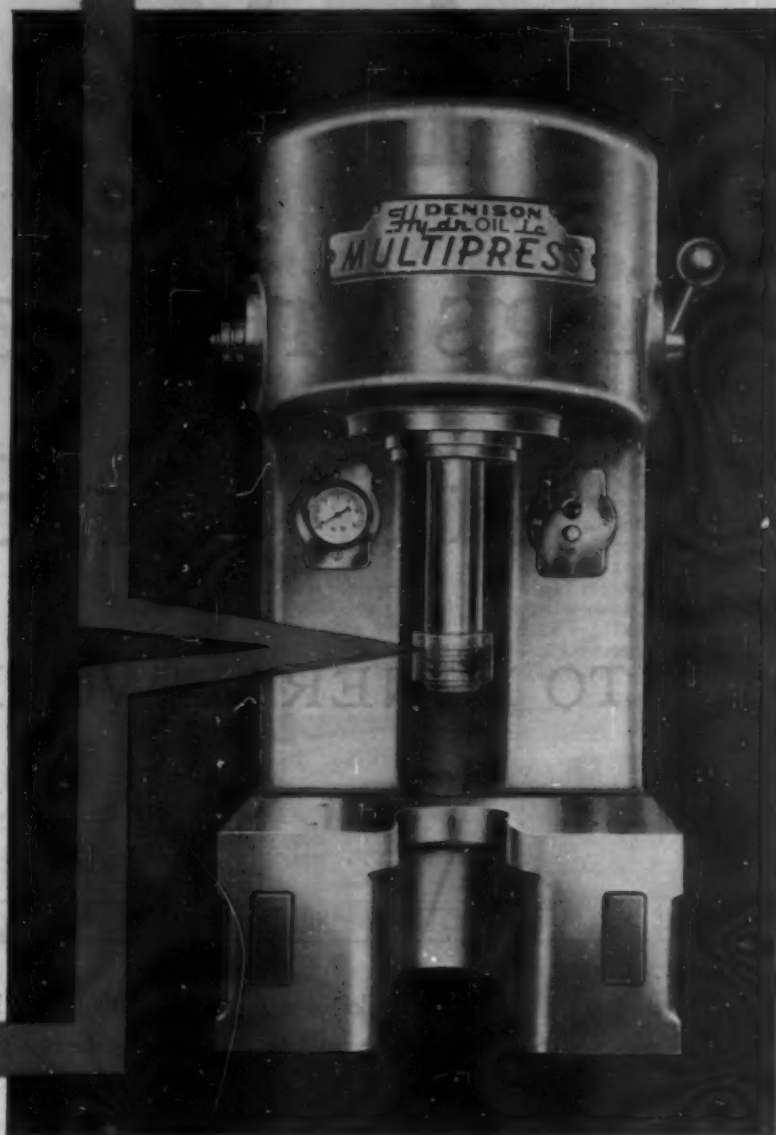
Corporation

PLASTICS DIVISION

*Specificity
IN RESINS*

Where can
YOU use this
amazing new
VIBRATORY
ram action?
(Oil-Hydraulic)

Ram action that permits
short, rapidly-repeated
uniform pressure strokes
of regulative length,
frequency, pressure and
number per ram cycle



● So many startling advantages have been found in this new exactly-controlled vibratory ram action that, thus far, even we know only a few of its potential applications. Performance tests indicate that it may revolutionize scores of operations!

If your production includes any operation which you think might be improved by rapidly-repeated, uniform-pressure strokes, Denison engineers will be glad to adapt Vibratory

HydrOILic Pressure to your specific needs! Write for information today!

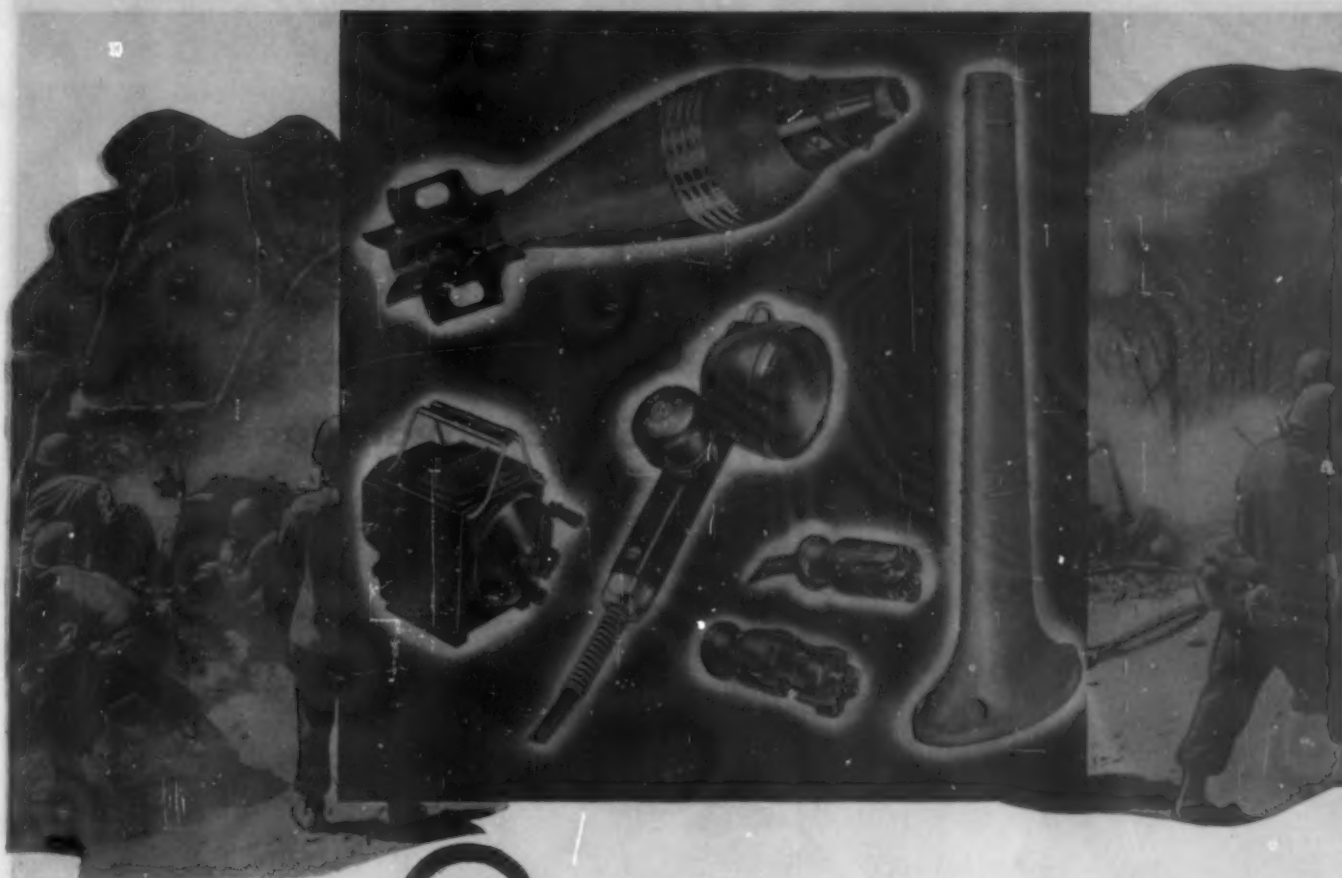
* * *

This new vibratory hydraulic pressure principle is available in the equally amazing Denison Multipress—a four-ton and six-ton bench-size oil-hydraulic machine tool that performs almost any type of production operation calling for controlled pressure. Let us send you the latest, fully-illustrated bulletin on MULTIPRESS.

The DENISON Engineering Co., 1176 Dublin Road, Columbus 16, Ohio

DENISON
EQUIPMENT & APPLIED
HydrOILic





Out of the welter of war ... *even better* **MOLDED PLASTICS**

WE IN THE plastics industry have learned a lot from this war. We've had to. The constant demands for better equipment . . . stronger . . . more precisely built . . . and faster . . . have resulted in amazing improvements all along the line. New materials . . . new methods . . . new techniques. With the result that we are accomplishing today things that were only a hope a short time ago.

We, at CMPC, have had our hand in these developments . . . many of them are exclusively ours. We've learned the new techniques, and become thoroughly familiar with the behavior of the new materials. We've installed thousands of dollars worth of new equipment . . . and are constantly adding more.

And all this is on top of more than two decades of peacetime experience in plastics.

This can mean a great deal to your peacetime products. You'll be able to do more things with plastics than ever before . . . and do them better . . . providing

stronger sales appeal and greater customer satisfaction.

Today, of course, war needs still come first. But, in the meantime, you'll find it good business to learn about the postwar possibilities of molded plastics. Why not call in a CMPC Development Engineer . . . today?

* * *

FREE! Our new book, "The Story of Plastic Molding," is packed with valuable information . . . fully illustrated with photos, charts, and diagrams . . . facts and figures you should have. Write for your **FREE** copy today.

**CHICAGO
MOLDED
PRODUCTS
CORPORATION**

1046 N. Kolmar Ave.  Chicago 51, Illinois

BRANCH OFFICES IN PRINCIPAL INDUSTRIAL CENTERS



*

FIBERGLAS

gives formed plastics parts

5 BIG advantages

Complicated aircraft duct saves man-hours on the production line because ducts are not dented or permanently deformed during installation.

The combination of Fiberglas textiles (fine fibers of glass twisted into yarn and woven into fabrics) and certain contact or low-pressure resins has resulted in a new and different structural material. It has many significant properties and qualities which excel those of any material previously available for commercial use.

As applied to the production of formed plastics parts, Fiberglas textiles, used as a reinforcement, assure:

1. Simplified fabrication
2. Higher impact strength
3. Better strength-to-weight ratio
4. Greater rigidity
5. Dimensional stability

In the production of dies and jigs, structural forms and complicated parts, the necessity of metal dies and machining is avoided, important time and cost savings are effected. For example,

the aircraft duct, illustrated above, is a one-piece fabrication, not an assembly of several parts.


Impact strength from five to ten times that previously obtained in laminates is now being attained through Fiberglas reinforcement. The glass fibers have great flexibility and stand high stresses without permanent deformation. They are not affected by moisture changes within the range of commercial usage, remaining dimensionally stable.

Possibly these properties suggest an application to the product you are now manufacturing for war, or are planning for postwar markets. Owens-Corning Fiberglas Corporation does not manufacture resins or finished laminates but will be glad to furnish experimental samples of Fiberglas and data on techniques in its use with plastics. Write: *Owens-Corning Fiberglas Corporation, 1876 Nicholas Bldg., Toledo 1, Ohio. In Canada, Fiberglas Canada Ltd., Oshawa, Ontario.*



FIBERGLAS ... A BASIC MATERIAL

*T. M. Reg. U. S. Pat. Off.



A 15 ounce capacity H-P-M Injection Molding Machine powered by H-P-M Hydro-Power Radial Pump.

Power for the Plastics Machines of Today and Tomorrow

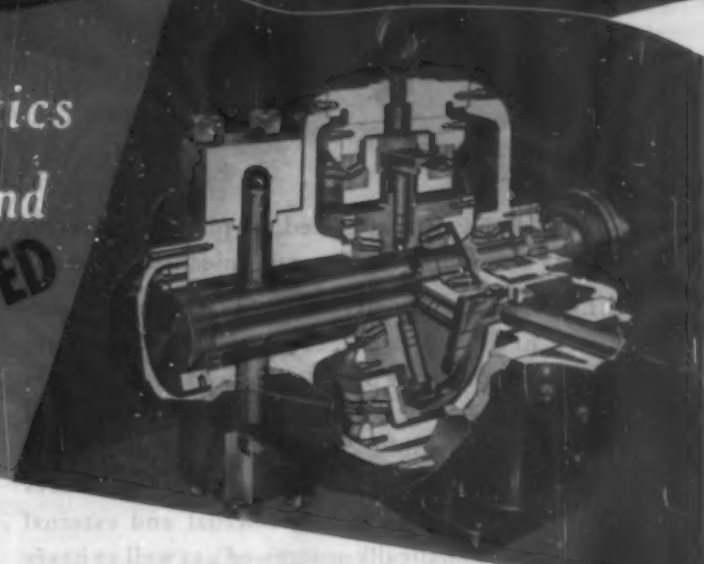
TIMKEN BEARING EQUIPPED

H-P-M All-Hydraulic Plastics Molding Machines are powered by the H-P-M Hydro-Power Radial Pump.

This pump has demonstrated outstanding performance and reliability in heavy duty hydraulic service in many types of H-P-M Hydraulic Presses. Its efficient and dependable service is due to its scientific design and fine precision construction. Tolerances of operating parts are measured in tenths of thousandths and these clearances are maintained for high volumetric efficiency.

The stationary valve pintle and the high-speed cylinder rotor in particular must be held within extremely close relationship with a minute operating clearance between them. This is done by mounting these parts on Timken Tapered Roller Bearings as shown in the sectional illustration.

Furthermore, any slight bearing wear that might occur after long periods of service can be taken



H-P-M Hydro-Power Radial Pump sectioned to show operating parts and locations of Timken Bearings.

up with split-hair accuracy through a simple external adjustment made possible by the design of the Timken Bearing.

To be sure of getting genuine Timken Bearing performance, see that the trade-mark "TIMKEN" appears on every bearing you use. The Timken Roller Bearing Company, Canton 6, Ohio.

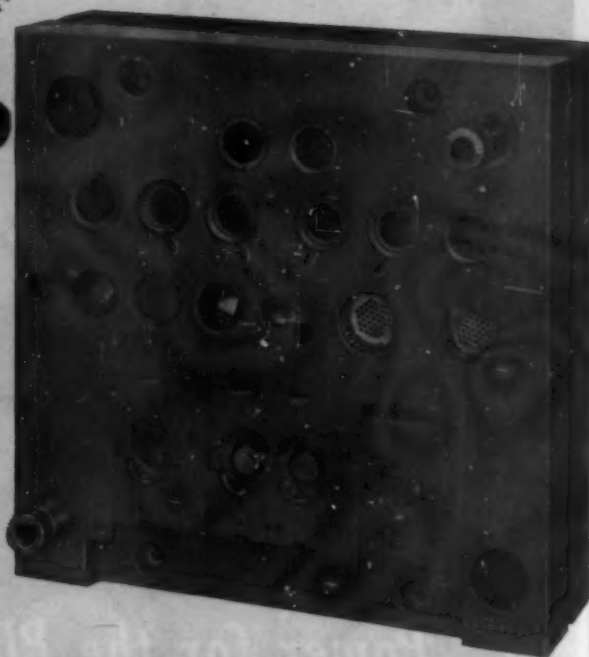
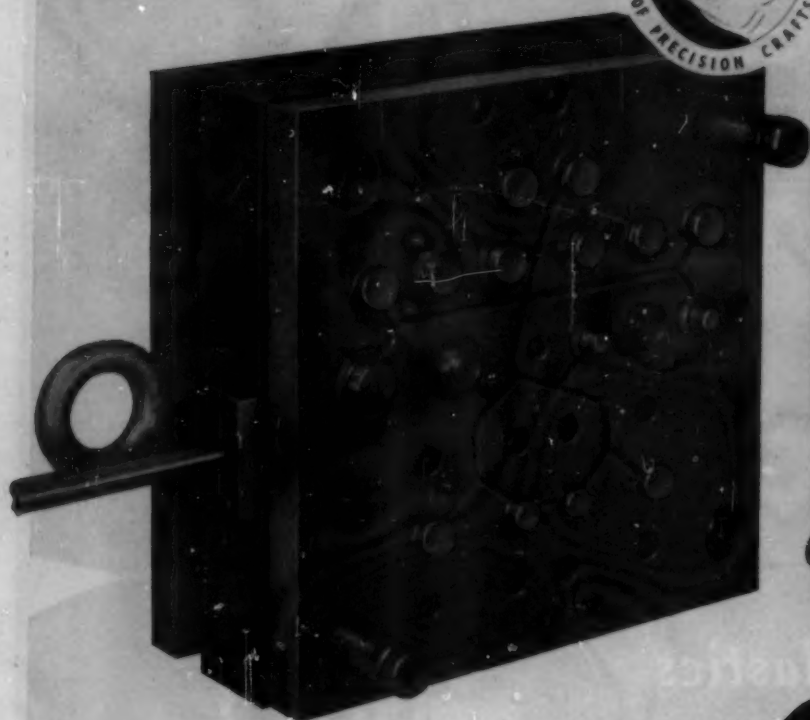


TIMKEN
TAPERED ROLLER BEARINGS

ACCURATE INJECTION MOLDING



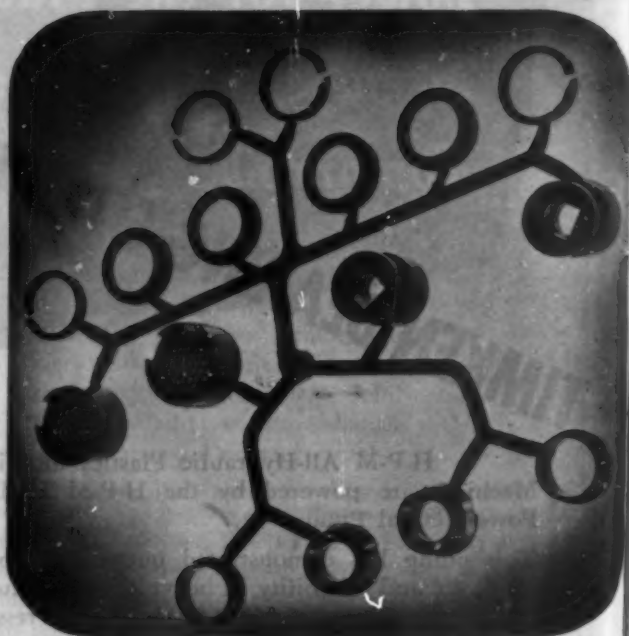
DEPENDS 90% ON THE TOOLS



TOOLING is recognized, by plastic engineers, as being 90% of accurate injection molding.

This intricate 16 cavity combination mold pictured here was engineered by Santay's plastic engineers and made by Santay's tool and die makers—both having years of experience in designing and making better tools. Not only is this mold made up of some 200 component parts, but it produces thermoplastic parts having internal and external threads (automatically unscrewed), as well as heavy undercut shoulders.

Santay continues to produce intricate precision-built molds—recognized as 90% of accurate injection molding.



INJECTION MOLDING AND METAL STAMPING • ELECTRO-MECHANICAL ASSEMBLIES



SANTAY CORPORATION, 355 NORTH CRAWFORD AVE. CHICAGO 24, ILLINOIS

REPRESENTATIVES: POTTER & DUGAN, INC., 29 WILKESON STREET, BUFFALO 2, NEW YORK • PAUL SEILER, 7779 CORTLAND AVENUE, DETROIT 4, MICHIGAN • QUEISSER BROS., 710 E. NINTH STREET, INDIANAPOLIS 2, INDIANA

From Coast to Coast

America is stocked with Panelyte sheets, rods and tubes and staffed with sales engineers at your service

in Canada: Montreal, Toronto, Vancouver



in Mexico: Mexico City

The Panelyte network of strategically located warehouses and sales offices was established to serve Industry promptly. Stocks of sheets, rods and tubes are carried . . . ready for prompt shipment.

Competent Sales Engineers are available to consult with you on designing, and manufacturing techniques for the economical production of fabricated parts and molded shapes in thermosetting laminated plastics.

The demand for Panelyte fabricated and molded parts has necessitated the building of a new 60,000 sq. ft. Fabricating Plant at Trenton. It will be the most modern fabricating plant in the laminating industry. Space formerly occupied in the main plant by the Fabricating Department will be used by the enlarged Molding Department.

Write for our factual Engineering Data Book.

PANELYTE

the structural plastic

PANELYTE DIVISION
ST. REGIS PAPER COMPANY
230 PARK AVENUE
NEW YORK 17, N. Y.

Sales Offices: Atlanta, Boston, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Kansas City, Los Angeles, New Orleans, Phoenix, Portland, St. Louis, St. Paul, San Francisco, Seattle, Syracuse, Trenton, Buenos Aires, Johannesburg, Mexico City, Montreal, Sao Paulo, Toronto, Vancouver.

★ MASS PRODUCTION OF SHEETS, RODS, TUBES, MOLDED FORMS, FABRICATED PARTS IN PAPER, FABRIC, FIBRE GLASS, WOOD VENEER AND ASBESTOS BASE LAMINATES



"The bigger the family — the better the service"

THAT being true, you can be sure of getting the best packaging service you've ever enjoyed from the Continental family. For Continental's family has been greatly expanded.

Continental offers you a combination of years of technical skill and experience with increased resources and facilities. This combination assures a calibre and range of service capable of producing the best package for your product.

Continental's packages are varied—metal containers, (Packers' cans for food, General Line cans for household and industrial products), liquid-tight paper cups, containers, fibre cans and drums, steel pails, other heavy-duty containers.

We're in war work now. But keep your eye on Continental's trademark! It stands for *one* company with *one* policy—to give you only the very best in quality and service.

Tune in: "REPORT TO THE NATION" every week over coast-to-coast CBS network



CAN COMPANY, INC.

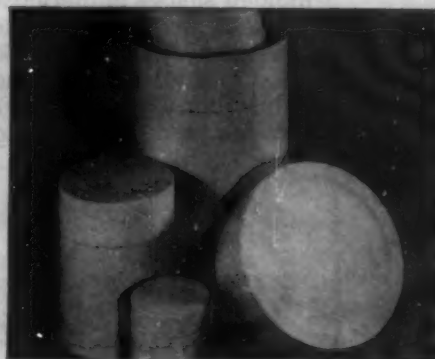
FIBRE DRUMS The Container Co., Van Wert, Ohio

LIQUID-TIGHT FOOD CONTAINERS Boothby Fibre Can Co. Roxbury, Mass.

PAPER CUPS Mono Containers, Newark, N.J.

COMBINATION PAPER AND METAL CONTAINERS Headquarters: 330 W. 42d St., New York 18, N.Y.

13 Plants—Sales offices in all principal cities



Continental Fibre Drums—Continental makes a full line of sturdy fibre drums, both the all-fibre and the metal-end types, for shipping dry bulk products, dry paint, flaked or powdered chemicals, resins, viscous greases, asphalt, pitches, waxes, dyestuffs. Our drums are "LEVERPAK," 12 gal. to 75 gal., "FIBERPAK" (an all-fibre drum), 1/4 gal. to 67 gal., "STAPAK," 2 gal. to 33 gal., and "KEYSTONE," 10 gal. to 55 gal. Wide selection of linings, coatings, treatments and constructions to meet specific requirements.



Masterpieces
for the millions...

Apparent to the knowing eye is the craftsmanship
that identifies the work of the master painter. Columbia —
working in the modern medium of colorful plastics — likewise
evidences that touch of genius which marks the true artist.

Columbia plastic combs, miracles of beauty and utility,
are but one of many masterpieces produced by Columbia.

for the millions . . . by the million.

COLUMBIA

Plastics

COLUMBIA PROTECTORITE CO. INC. • CARLSTADT, N. J.

New York Office • Empire State Building • Room 7013

Skyrider



Compression Molding
OF THINGS TO COME ...

The world of tomorrow will behold innovations
in product design that are but dreams today.

Whether you are seeking a new table radio design or production of your own design, think of
International Molded Plastics Inc. for quality molding.

INTERNATIONAL MOLDED PLASTICS, INC.

4387 WEST 35th STREET

CLEVELAND 9, OHIO



Simplify Your Access Panel and Door Assemblies...



Fasten them faster with Quick-Lock

Fastening removable access doors and panels need not be a laborious and costly production or assembly operation—not if they're fastened with QUICK-LOCK.

Designed for simple installation, QUICK-LOCK requires no special tools. It speeds up mounting and demounting detachable panels with only a 90° turn required to lock and unlock it *in a jiffy*.

The flexible mounting and tapered stud makes QUICK-LOCK ideal for assembling curved sheets and insures a tight fit when locked. Stud is self-ejecting when unlocked. Minimum deflection is assured—only initial loads are carried by the helical spring. Solid supports take up increased loads.

Industrial and agricultural equipment manufacturers would do well to analyze the cost-saving features of QUICK-LOCK's simple design. A good way would be to call in a Simmons Engineer and discuss the economy of a QUICK-LOCK installation as compared to your present fastening method. Why not send for him today?

SIMMONS FASTENERS

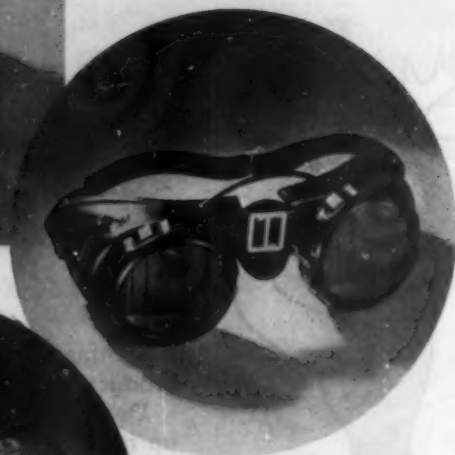
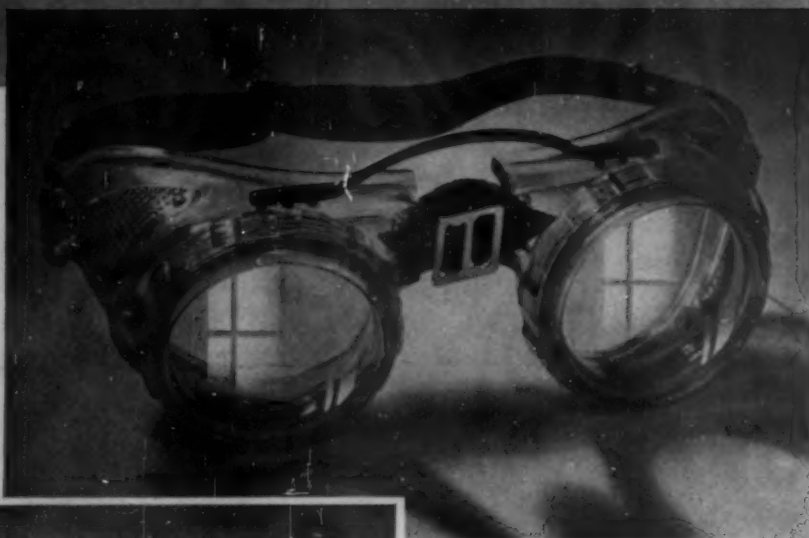
SIMMONS FASTENER CORPORATION • 1754 NORTH BROADWAY, ALBANY 1, N. Y.

PLASTICS

FOR SAFETY GOGGLES

Watertown molds all the frames for the industrial safety goggles made by The Metro Manufacturing Company of Long Island City. Formerly compression molded of a phenolic material, all the new models are injection molded of crystal or black cellulose acetate.

Naturally, these goggles require the utmost precision in molding and assembling.



It was because of Watertown's 30 years of experience in molding that they were chosen by Metro for this meticulous job.

Watertown's laboratory tested plastics insure satisfactory service from parts in actual operation. Possibly Watertown engineers may help you solve some molding problem. Consult them at The Watertown Manufacturing Company, Watertown, Connecticut. Or check with their branch office in Cleveland or one of their sales offices conveniently located in New York, Chicago, Detroit, Milwaukee or Hawaii.



Watertown



A NAME AS OLD AS THE PLASTICS INDUSTRY

Send for the new Watertown Book of Plastics. Write to Dept. (CDH) at Watertown.

PROVED BY WAR

FOR IMPROVED PEACETIME PRODUCTS...

DURITE

P L A S T I C S

RESINS

THERMOSETTING PHENOL-FURFURAL AND PHENOL-FORMALDEHYDE TYPES

ADHESIVES

THERMOSETTING AND COLD-SETTING

THERMOSETTING CEMENTS

FOR METAL-TO-METAL AND OTHER APPLICATIONS

MOLDING COMPOUNDS

OIL SOLUBLE RESINS

WATER SOLUBLE RESINS

NEW PROCESSES

OUR EXPERIENCE IS AVAILABLE TO YOU

DURITE PLASTICS

INCORPORATED

FRANKFORD STATION P. O. PHILADELPHIA 24, PA.

REPRESENTATIVES LOCATED AT:

★ 3838 Santa Fe Ave., 1274 Folsom St., 67 Lexington Ave., 4226 Cedar Springs,
Los Angeles 11, Cal. San Francisco 3, Cal. Buffalo 9, N. Y. Dallas 4, Texas ★
352 Plymouth Road, 245 W. Franklin St., 2711 Olive St., 4851 S. St. Louis Ave.,
Union, New Jersey Morrisville, Pa. St. Louis 3, Mo. Chicago 32, Ill.

A New Development In RIEGEL-X Plastics Surfacing Materials

The success of Riegel-X as a functional material is well known.

Now there emerges a new group of Riegel-X papers that provides revolutionary changes in the design and possible use of finished products by merely adding a plastic surface to such materials as wood, plywood, hard fibreboard, asbestos board, molded sisal, laminated fabrics and fibre glass.

X

These new Riegel-X papers, especially designed for surfacing, are already impregnated (not coated) with resin. The resin is thoroughly and evenly distributed, resulting in a soft, pliable material, easy to handle and form. Either low or high pressure may be used.

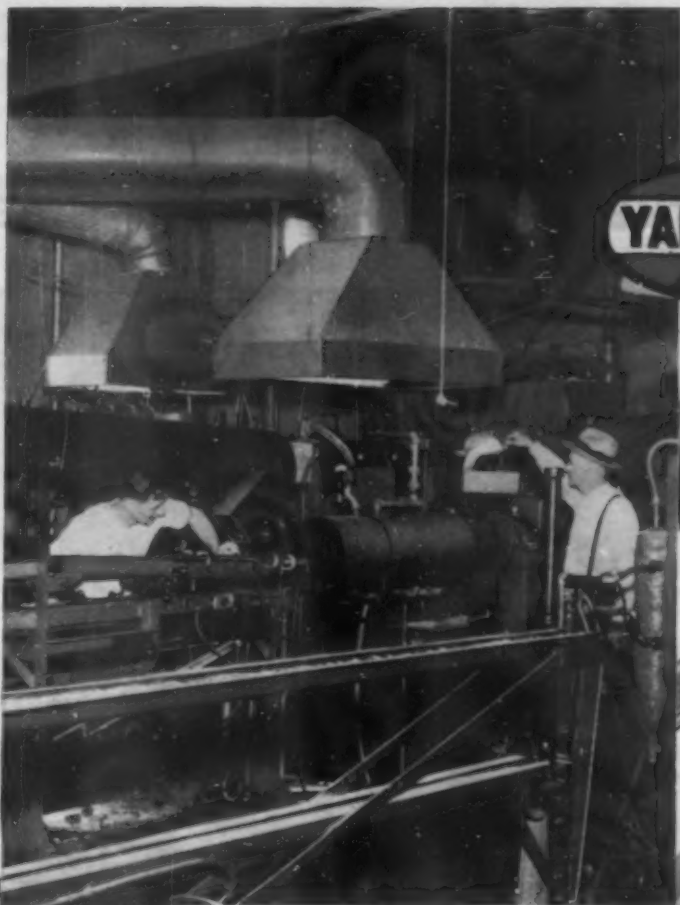
X

Riegel-X papers have hundreds of applications awaiting development. Large sections can be made with precision. They are resistant to water, alcohol, oil and gasoline. Riegel-X papers are electrical and thermal insulators, fire resistant and light in weight—about half the weight of aluminum—and strong.

PLAN NOW: Progressive manufacturers have profited repeatedly by experimenting with Riegel-X. Paper production is still limited, but our ability to help you in your planning is not. Write for a technical bulletin to Riegel Paper Corporation, 342 Madison Avenue, New York 17, N. Y.

RIEGEL-X

**X A group of plain and impregnated base
papers for high or low pressure laminates X**



Extruded by Yardley Plastics—Aircraft antenna lead-in cable—Drafting Spliners—Wall Moulding of different types and colors.

YARDLEY

Putting EXTRUSION to Work!

ABOVE, you see a few examples of how the combination of extrusion processing and engineering ingenuity can result in better products . . . or even in products it would be impossible to fabricate in any other way.

Yardley Plastics Company of Columbus, Ohio, rightfully take great pride in developing new and improved plastic products. And, much

of their work requires holding product to close tolerances . . . precision control must be maintained through every step.

They selected National extruders for their great accuracy and dependability, and for their flexibility in the extrusion of a wide range of plastic formulations.

Remember, it is more than likely

that your products can be produced more economically, improved in appearance or their serviceability by the use of extruded plastics.

So, examine the profit potentials of plastics extrusion in relation to your products, then write to America's leading manufacturer of plastics extrusion machinery for further information about your specific requirements.



NATIONAL RUBBER MACHINERY CO.

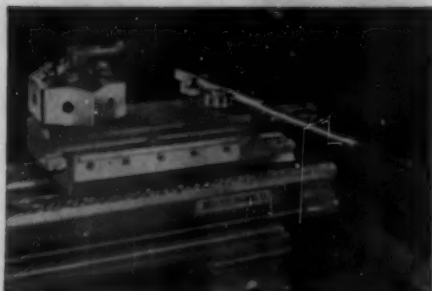
General Offices: Akron 11, O.

Plastics

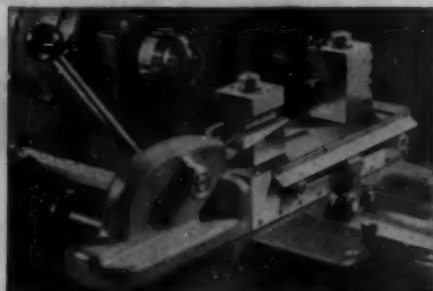
MACHINERY DIVISION

MORE VERSATILITY

FROM SOUTH BEND LATHES WITH THESE ATTACHMENTS



Handlever Bed Turret for 9" or 10" lathes multiplies their versatility through multiple tooling for repetitive operations.



Handlever Double Tool Cross Slide for 9" or 10" lathes speeds up successive operations through the use of three cutting tools.



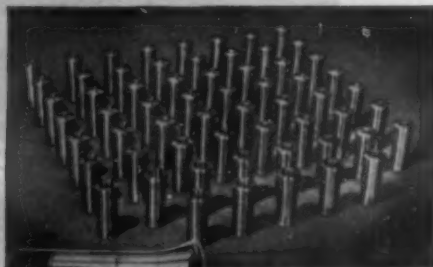
Screw Feed Double Tool Cross Slide for 16" lathes has both manual and power cross feed. Large graduated feed dial.



Handlever Draw-in Collet Attachment saves time on bar work. Collet can be operated and stock fed without stopping the spindle.



Handwheel Draw-in Collet Attachment is ideal for production and toolroom work that requires extremely close tolerances.



Collets from 1/16" to 1" in 1/64" steps. Complete sets of collets will save time.



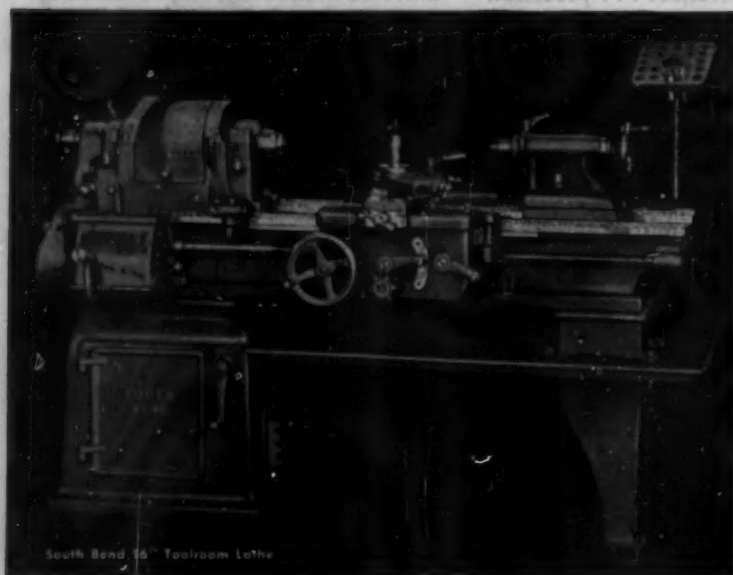
Center Rest and Follower Rest for supporting long bar work while turning, threading, drilling, boring, etc.



4-Way Turret Tool Block permits use of four cutting tools which simplifies tooling for repetitive operations.



Taper Attachment for accurate taper turning and boring. Quickly engaged. Graduated in both degrees and taper per foot.



South Bend 16" Toolroom Lathe

These and other practical attachments greatly increase the capacity of South Bend Lathes for handling a wide variety of operations. They simplify difficult set-ups, save time and effort, and often eliminate delay and expense of making special fixtures.

Write for Catalog 77R in which all South Bend Attachments are illustrated and described. Also, state size and type of lathe required. These attachments are only available for use on South Bend Lathes.

BUY MORE WAR BONDS—SAVE FOR LATHES



**SOUTH BEND
LATHE WORKS**

Lathe Builders for 38 Years

442 E. MADISON STREET, SOUTH BEND 22, INDIANA

BEFORE
sion,
strato
planes
gruell
that s
super
compo
anti-f
lamin
from
nishes
except
up to 3
at ten
from 3
zero.

Lan
BAKEL

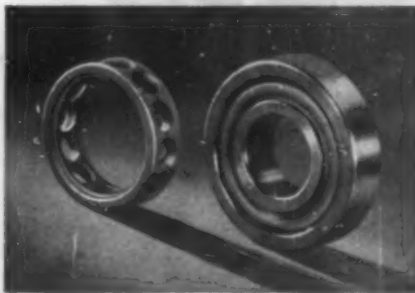


"SUPERCHARGING" NIPPON'S SKIES

BEFORE THE BOEING B-29s' first mission, engineers had to conquer the stratosphere — enable the giant planes to fly at glacial altitudes for gruelling hours. The "secret weapon" that solved the problem is a turbo-supercharger. Its most important component parts are super-precision anti-friction bearings mounted in laminated plastic retainers. Made from BAKELITE laminating varnishes, these retainers function at exceptionally high bearing speeds—up to 30,000 r.p.m. They also operate at temperature extremes, ranging from 350 deg. F. to 60 deg. below zero.

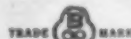
Laminated plastics based on BAKELITE resin varnishes give de-

signers, product engineers, and industry the advantages of dimensional stability and of machineability to extremely close tolerances. Light in weight, high in dielectric strength, low in oil absorption, and exceptionally resistant to abrasion, laminated



plastics in sheet, tube, and rod form, bring an outstanding combination of properties to such diversified products as gears, electrical coil forms, aircraft pulleys, fairleads, and propeller supports, telephone, radio and television equipment, hospital table tops, industrial helmets, and countless other products.

Write Department 23 for booklet describing laminated plastics, made from BAKELITE laminating varnishes.



BAKELITE CORPORATION

Unit of

Union Carbide and Carbon Corporation

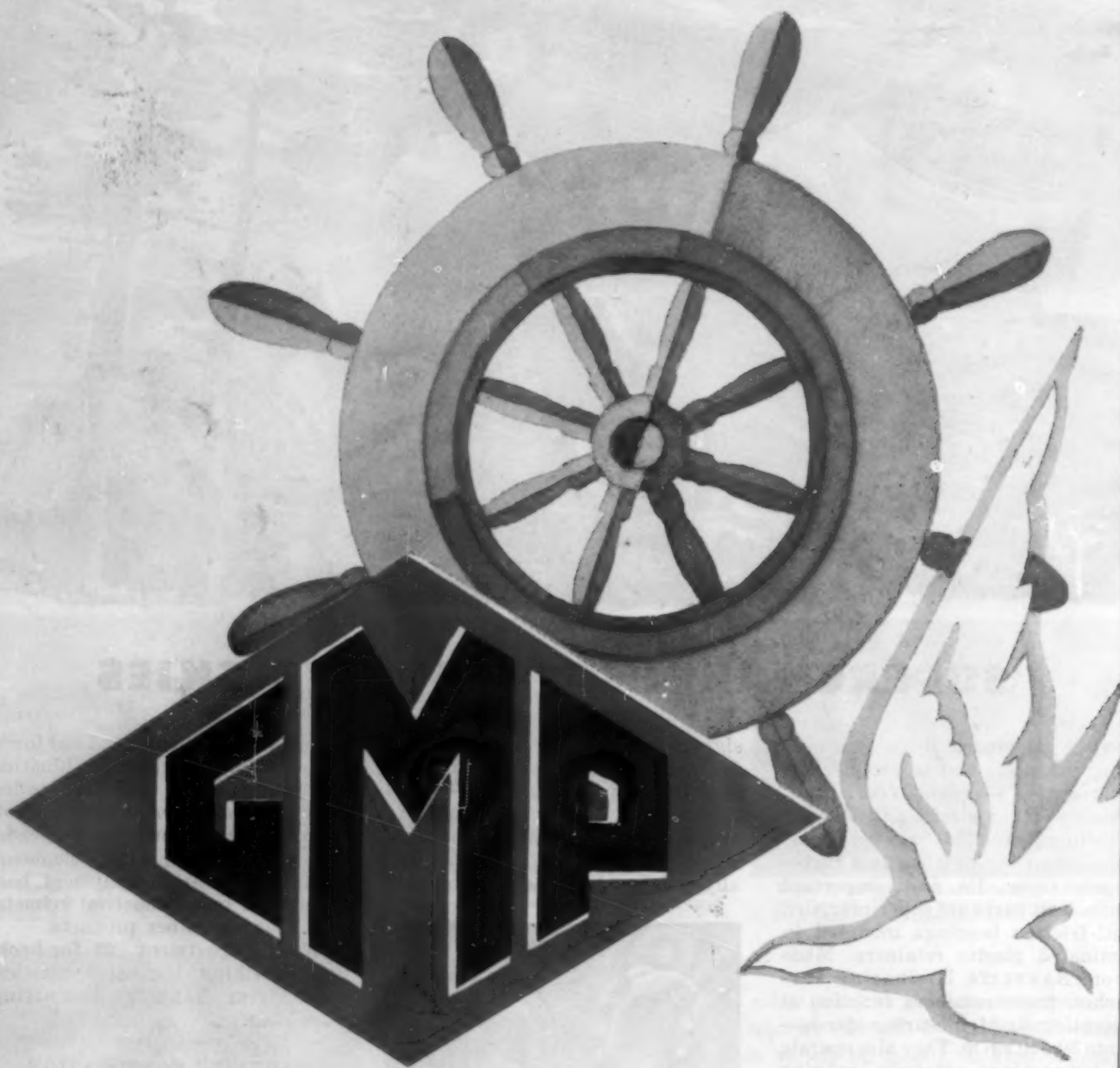


30 EAST 42ND ST., NEW YORK 17, N.Y.

BAKELITE LAMINATING PLASTICS

TRADE-MARK

Excellence in craftsmanship is the true course
we follow from print to product



Molders of Plastics



GENERAL MOLDED PRODUCTS • INC

GENERAL OFFICE AND PLANT AT DES PLAINES • ILLINOIS

INCREASE PRODUCTION! IMPROVE FINISH!

Abolish

**DISCOLORATION
DISTORTION
FLOW**

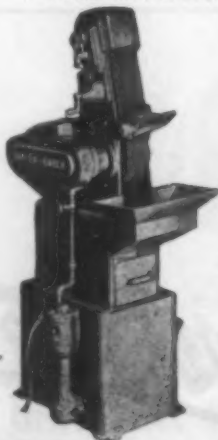
PORTER-CABLE

**WET
OR
DRY**

ABRASIVE BELT SURFACER

Does them all on
PLASTICS...

For thermoplastics and some thermo-setting plastics, experience has shown that the PORTER-CABLE Surfacing methods are best. In Wet-Belt Surfacing, the coolant is sprayed on the belt before and after cutting, keeping it free and clean. Because there is no heat, the grindings do not "weld" and load the belt. Wet or Dry—the PORTER-CABLE Surfacing technique does a better, closer, finer job because a flexible belt follows the contour and gets into places other power tools won't reach. For repeat operations a padded platen fits the belt to the contour of the job. Round pieces, held on an arbor, rotate with the belt for perfect roundness.



MODEL WG-4 — A new all-around Wet-Belt Surfer for Job Shop, Production Line, Toolrooms — or Salvage Department!

Ideal for light operations or continuous production grinding in the plant. Grinds flat on the platen — fine contact grinding on the resilient contact roll. Self-contained coolant system and re-circulating tank. Chip or clean-out drawer traps all grindings and waste. Tilted head gives free use of contact roll and full use of coolant on belt.

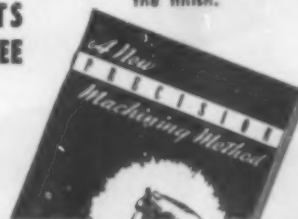
Most operations performed free-hand!
Runs cooler—faster—dust-free!
Machines flats—bevels—generates radii



MODEL B-6W — especially designed for curved or irregular work. Most jobs can be handled freehand, or with simple fixtures. A single pass in a fraction of the usual time — cuts cost and improves the finish.

**HERE ARE ALL THE FACTS
WRITE TODAY for your FREE**

copy of the handbook, "A New Precision Machining Method." It describes a process as new — as vital — as the Plastics industry itself!



PORTER-CABLE MACHINE CO.

1606-1 N. Salina St., Syracuse, N. Y.

Please send me a copy of "A New Precision Machining Method."

Name.....Position.....

Company.....

Street.....

City.....State.....

^{Not} WANTED



"JACK THE RIPPER"

Unwanted in any shop because of broken heads... slow work... quick temper... wasted screws... and, worst of all, *ripped-up work*. As long as he stays on slotted screws, he can't help it if his driving stays crooked!

...but he'll GO STRAIGHT if you'll give him

AMERICAN PHILLIPS SCREWS

You can't blame a good man for going wrong with slotted screws. For if he drives one straight, it's mostly by sheer accident and main strength.

But give this same man a fistful of American Phillips Screws... and a power driver with a 4-winged Phillips bit... *and you've got a new man entirely.*

His output will speed up as his confidence builds up... as he finds that he can drive American Phillips Screws *no way BUT straight*... as he finds the 4-winged driver can't twist out of the tapered recess, can't rip up the work-surface or burr the screw-head.

He finds, too, that American Phillips Screws are 100% fit for duty... and that's because of American's 4 inspections that assure a higher "perfection-percentage" in every shipment.

RESULT: Total time-savings as high as 50%... plus important savings in screws and materials.

AMERICAN SCREW COMPANY, PROVIDENCE 1, RHODE ISLAND

Chicago 11: 589 E. Illinois Street

Detroit 2: 502 Stephenson Building

AMERICAN PHILLIPS *Screws*

PUT THE SCREWS
ON THE JAPS...
BUY WAR BONDS

Radio

Household
Products

Fixtures

Cosmetics

Tools

**UNIVERSAL
PLASTICS**

Toys

Parts

Hardware

Electrical

Novelties

Accessories

Jewelry

UNIVERSAL PLASTICS CORPORATION • NEW BRUNSWICK • NEW JERSEY
270 Madison Ave., New York 16, N. Y. • Representatives in Chicago, Philadelphia and Detroit

15,000,000

plastic pencil
ferrules per
month!

Fifteen million a month — that's a lot of ferrules . . . and a lot of quality, because each little hollow cylinder is a precision piece . . . the outside diameter being held to $\pm .002$ and the inside diameter to $\pm .001$.

Either end, like a ferryboat, is a forward end or stern end. There is no telling, due to hopper feed in pencil assembling, which end will contact the wood or which end will receive the eraser — therefore, both ends must be accurate — taperless — uniform — smoothly finished.

Sterling is molding pencil ferrules in colors, in plain as well as ringed designs . . . and to such a degree of satisfaction that our customers are staying with plastic, even though metal is again available.

Should you, as were this item's manufacturers, be faced with product problems, call upon Sterling to see you through! Our injection molding know-how is experience-backed!

STERLING PLASTICS CO.



1140 COMMERCE AVENUE, UNION, N. J.

PLASTIC

For the Fastest-Growing Industry in Our Age of Change

PRESSES

The future of plastics need not depend upon low-cost production, but with plastics—as with everything else—costs will play an important part in the future of many producers.

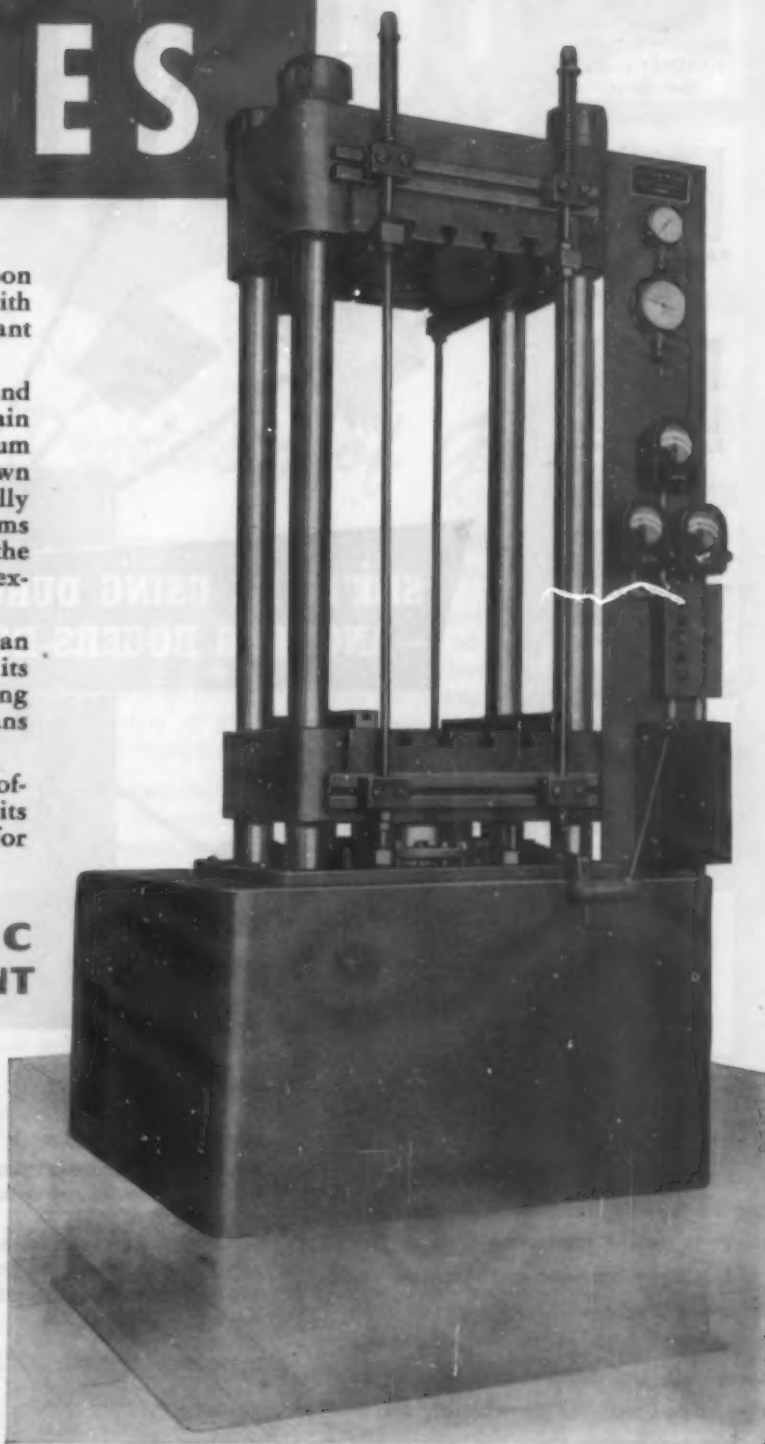
Special-purpose presses are coming more and more into the picture—presses built to do certain types of work *exceptionally* well, with a minimum of rejects, effort, and expense. The press shown here is a good example. Developed especially for deep molds with thin sections, it performs *all functions* on low-pressure power; cuts-in the high-pressure circuit only when needed; is flexible, variable, *fully automatic*.

Designs such as this will *supplement* rather than outmode the more usual types, for each has its own particular field of application. It's knowing which can serve each purpose best that means *money-saving* quality production.

In solving your pressing problems Elmes offers you a wealth of experience which by its service *today* gives even greater promise for *tomorrow*.

ELMES HYDRAULIC EQUIPMENT

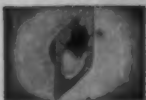
Elmes Model 6622, self-contained, 225-ton plastics press for deep molds with thin sections. Automatic operating cycle includes: (1) partial mold closure, with a pause for desired heating time; (2) full closure, followed by a slight reopening for breathing; (3) breathing interval, followed by closure for curing; (4) curing interval, reopening, and return of platen to starting position. Colored lights flash on to indicate occurring stages, any of which may be omitted.



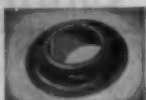
ELMES ENGINEERING WORKS of AMERICAN STEEL FOUNDRIES, 225 N. Morgan St., Chicago 7, Ill.
Also Manufactured in Canada

METAL-WORKING PRESSES • PLASTIC-MOLDING PRESSES • EXTRUSION PRESSES • PUMPS • ACCUMULATORS • VALVES • ACCESSORIES

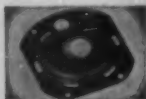
**PARTS FABRICATED
BY ROGERS**



KAYPAR fuel
pump protector



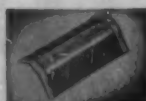
KAYGREY radio
dust cover



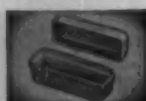
KAYGREY magneto
insulator



KAYGREY formed
insert



DURO motor
slot cell



DUROK capacitor
can liner



BAYRU packing
list protector



**SHE'LL BE USING DUROK*
-ANOTHER ROGERS-BORD**

FABRICATED PARTS used to insulate capacitors, loudspeakers, antenna systems and other radio components are now "in work" in Rogers' fabricating division. The radio industry has seen that it can advantageously use Rogers-Bord—and can have Rogers form, draw, punch, bend and shape these tough, high-dielectric materials. Rogers designs and produces the necessary dies in its own tool and die shop. The Rogers "you name it, we'll make it" slogan applies to special fabricating as well as to special fibrous and plastic materials. And it applies now.

To learn more, check and mail:

- ☐ Send me the ROGERS EXHIBIT BOX, containing fabricated parts and samples of Rogers-Bord.
- ☐ Have a Rogers representative bring samples and fabricated parts.
- ☐ We are enclosing blueprint for suggestions and quotation.

NAME AND TITLE _____

COMPANY _____

ADDRESS _____

ROGERS CORPORATION

Formerly

The Rogers Paper Manufacturing Co.

113 Mill St.,

Manchester, Conn.

***DUROK ROGERS-BORD**

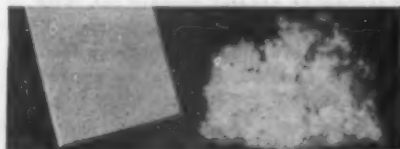
Purified, non-cotton, cellulose fibers have now been wet-laminated into a new high-strength, high-dielectric material with the lowest extractibles ever. Data on this electrical insulating surprise are contained in "This Is Durok". Write for it.





WHY CHEMCOT EXCELS

- CHEMCOT is the purest commercial form of cellulose on the market. Its high alpha-cellulose content (99% plus) and unusual degree of refinement produce stronger yarn, plastics and other products.
- The refinement of CHEMCOT can be more closely controlled than cellulose derived from other sources. It is the recognized chemical raw material for the cellulose products industries—not a substitute.
- CHEMCOT is produced in two forms—bulk and sheeted, permitting wide versatility of use.



FOR THE 4TH TIME—
ARMY-NAVY 'E' AWARD

Through collaboration of scientific genius and Mother Nature, the wealth of America is being wrought.

From the rich soil of the Deep South, cotton and its by-products are being developed into hundreds of industrial uses. Plastics and rayon, made from CHEMCOT, have played major roles in wartime needs—from bomber noses and rocket powders to parachutes. Out of War's needs have arisen amazing new uses for this all-important chemical cotton cellulose.

Men with imagination are seeking out the possibilities of cotton cellulose for new, improved products—so that tomorrow the world may enjoy better things.

REQUEST A SAMPLE TODAY

Quantities of CHEMCOT—a highly purified, uniform cellulose—are available to research chemists, designers and engineers for experimental purposes. There is no cost. Simply tell us your problem.

CHEMCOT is of only one quality—the best—but its process of manufacture is highly flexible, and can be made to conform to exacting specifications. Don't delay—write, wire or phone, giving tentative specifications or end uses.

SOME OF THE PRESENT USES OF CHEMCOT

ADHESIVES
CASINGS, SAUSAGE
CELLULOIDS
COATING AGENTS
COTTON, ABSORBENT
DIAPERS, DISPOSABLE

DYNAMITE
FIBRES, VULCANIZED
FILMS
FILTERS
FINISHES, TEXTILE
FLOC (SUEDE FINISHES)
FOILS, TRANSPARENT

GLASS, NON-SHATTERABLE
INSULATION
LACQUERS
LAMINATED PRODUCTS
LEATHER, ARTIFICIAL
LINOLEUM
NAPKINS, SANITARY

PAPER
PAPER PRODUCTS
PLASTICS
POLISH, NAIL
POWDER, SMOKELESS
RAYON YARNS

SOUTHERN CHEMICAL COTTON COMPANY

CHATTANOOGA 10, TENNESSEE

THE Thermatron LINE

of electronic dielectric heat generators includes a size for every use—for heating thermosetting materials—for welding thermoplastics—for laboratory research or for rugged production requirements.

THREE OUTSTANDING UNITS



"The HEATMASTER"—Type K-5—5 KW. output. Applicable for plastics, dehydration, sterilization and other purposes. BTU output, 17,065 per hour. 220 volts, 60 cycle, three phase. 5-15-30 megacycle frequency as specified. Width: 24", depth: 28", height: 59". Weight, approximately 1,000 lbs. Mounted on rubber casters. As supplied for plastics or general purpose use, Type K-5 includes electrodes, built-in work chamber, automatic operation. Completely self-contained, ready-to-use. A compact, power-packed model, particularly designed for heavy-duty preheating in the plastic molding industry where floor space is at a premium. Will heat a 3.3 pound preform in one minute or a 5 pound preform in 90 seconds. Its generous capacity also makes it suitable for rugged general purpose production use as well as research requirements involving substantial power. Type K-5-S is substantially the same as Type K-5 except that it is especially adapted for bonding, welding or sealing thermoplastic sheeting, such as Koroseal or Vinylite.

"The HEATMASTER Jr."—Type K-3—2½ KW. output. For laboratory and plastics uses. BTU output, 8,550 per hour. 220 volts, 60 cycle, single phase. 5-15-30 megacycle frequency as specified. Width: 24", depth: 28", height: 59". Weight, approximately 750 lbs. Mounted on rubber casters. As supplied for heating preforms, Type K-3 includes electrodes, built-in work chamber, automatic operation, and constitutes a completely self-contained, ready-to-use model for preheating plastic preforms or any other use requiring moderate power. Also supplied as Type K-3-S especially adapted for bonding, welding or sealing thermoplastic sheeting.



"The WELDMASTER"—Type K-1—1 KW output. For sealing or general purpose use. BTU output, 3,413 per hour. 110 or 220 volts, 60 cycle, single phase. 5-15-30 megacycle frequency. Width: 24", depth: 28", height: 38". Weight, approximately 600 lbs. Mounted on rubber casters. May be fitted with same oven or electrode chamber as Types K-5 and K-3. Excellent as a pilot model for development work or for production requiring limited power.

"The POWERMASTER"—Type K-15. For heavy duty requirements, the Type K-15 Thermatron with an output of 15 kilowatts is available as a standard model. BTU output 51,200 per hour. 220-440 volts, 60 cycle, three phase. A high powered model of unusual flexibility, available in 5, 15 or 30 megacycles.

SERVICE — NATIONWIDE

GUARANTEE — COMPLETE

Send for our THERMATRON circular describing standard models ranging in size from 500 watts to 30 kilowatts. Units of any size designed and built.



RADIO RECEPTOR COMPANY, INC.

251 WEST 104th STREET

NEW YORK 11, N.Y.

Engineers and Manufacturers of Airway and Airport Radio Equipment

SINCE 1927 IN RADIO AND ELECTRONICS



Guernsey Cow, injection
molded of cellulose acetate
butyrate for Montgomery
Ward & Co., Chicago.



HOW TO MILK A

Plastic Cow

This plastic cow won't give the customary lacteal fluid, but it will give something equally beneficial in its own way. "Milking" this cow through a thorough examination of its detailed perfection will fully reveal Mills' molding versatility . . . versatility of exceptional value when applied to helping you in your peacetime production problems. Montgomery Ward & Co., in promoting the sale of this cow to livestock breeders, 4H Clubs and agricultural colleges, advertise it as "the perfect Guernsey of the future." Truly a model of bovine perfection against which all Guernseys can be judged.

Naturally, Mills has made it a model of injection molding perfection. Attaining this perfection demanded the full ingenuity of Mills' engineers and craftsmen . . . men experienced in successfully solving injection molding and extrusion problems from the commonplace to the highly unusual. Consult Mills and assure yourself of receiving the cream of quality in thermoplastics knowledge and workmanship.

Write on your letterhead for the new Injection Molded and Extruded Plastic catalogue. Or, for detailed information about **MILLS PLASTIC*** pipe, tubing and fittings, write for circulars containing data and illustrations.

*Trademark Reg



ELMER E. MILLS CORPORATION

Molders of Tenite, Lumarith, Plastacela, Fibestos, Lucite, Crystallite, Polystyrene, Styron, Lustron, Lualin, Vinylite, Geon, ~~Cellulose Acetate~~, *Saran and Other Thermoplastic Materials

153 WEST HURON STREET

CHICAGO 10, ILLINOIS

Born of War . . . ready for peace



Official U. S. Navy Photograph—Wide World Photos.

Photograph of binoculars courtesy of Carbide and Carbon Chemicals Corporation

Plastic sheeting **CORDO-BONDED** to aluminum bodies

CORDO-BOND Adhesives have been highly successful in combining Vinylite® Sheeting to aluminum binocular bodies and brass spy-glass bodies. They have passed all tests to which these glasses are subjected: extreme temperatures, humidity, salt spray,

impact and the greatest test of all . . . Army and Navy combat conditions throughout the world.

As for war—CORDO-BOND Adhesives and the techniques of CORDO-BONDING are now available for coming peacetime, mass production applications—for the bonding of plastics, metals, wood and other materials, to each other and to one another. Write, giving full details for exact analysis and recommendations.

other CORDO products

- CORDO-CLAD • Plastic Metal Coatings
- CO-RES-CO • Maintenance Coating
- CORDO-FLEX • Air-dry Strip Coating
- CORDO CLOTH • Plastic Surfacing for Textiles

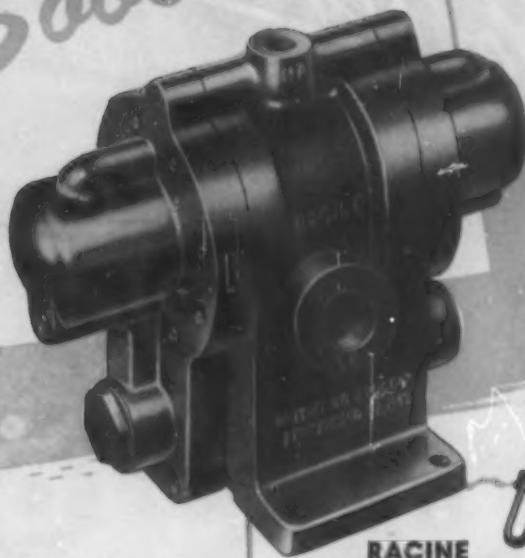
CORDO CHEMICAL CORPORATION
34 Smith Street
Norwalk, Connecticut

*VINYLITE IS THE REGISTERED TRADE MARK OF CARBIDE AND CARBON CHEMICALS CORPORATION

CORDO-BOND

HYDRAULIC Pressure Boosters

3,000 LBS. P.S.I.

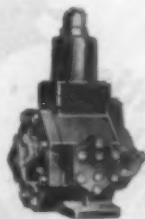


RACINE Booster Features

- * Use any pump—yet develop extra pressure without increase in motor power.
- * Compact, simple—No special foundation or supports required.
- * Freedom from repairs—No gears to wear or complicated mechanism requiring adjustment.
- * Use regular low pressure valves—No special equipment to buy.

This patented RACINE development will produce the needed higher pressures in your oil hydraulic circuits. It is available in several ratios, as high as 7 to 1. Maximum delivered pressure 3000 lbs. Maximum output 5 G.P.M. A 5 to 1 Unit will automatically convert 25 gallons of oil at 500 lbs. P.S.I. into 5 gallons at 2500 lbs. P.S.I. Ideal for handling peak loads in many pressing and closing operations.

The RACINE Pressure Booster is very compact. Size 10 1/8" x 8 1/8" x 18". It may be placed anywhere in the circuit. No special foundation needed. Standard low pressure valves may be used. For maximum benefits and Volume Variation use the booster with RACINE "Variable Volume" Oil Hydraulic Pumps. Ask for our Bulletin No. 1404 and also give us an outline of your hydraulic problem.



"Variable Volume" Oil Hydraulic Pumps

RACINE "Variable Volume" Pumps are adaptable to a wide variety of uses. They provide smooth, oil-cushioned operation for your products. Available in three sizes, 12, 20 and 30 G.P.M., operating at pressures up to 1000 lbs. P.S.I. This equipment assures maximum flexibility at low operating cost. Fully explained in our Catalog P-10-C. Get your copy today. RACINE TOOL AND MACHINE COMPANY, 1759 State Street, Racine, Wis.



RACINE

THE PRODUCTION SAWS OF MODERN INDUSTRY

For the high speed cutting of any metal from soft aluminum tubing to hard alloy steel. A full line of machines for general purpose and high production metal cutting work. Capacities 6" x 6" to 20" x 20". Fully explained in our Catalog No. 12.



Hobbed Details



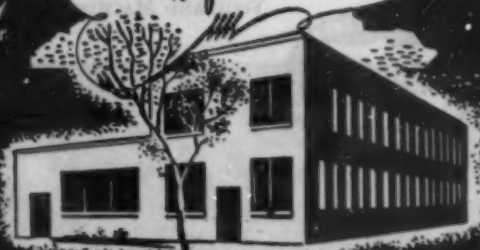
Thrills are in store for the ladies when they see compacts molded from this beautiful cavity hobbed from hand engraved hobs by Midland. It is a perfect example of Midland's development of the art of duplicating the fine handwork of skilled engravers by means of hobbed cavities.

Learn more about "Hobbed Cavities by Midland". Write for your copy of our book, "Shaping Tomorrow Today".



**MIDLAND DIE
AND ENGRAVING COMPANY**
1800 W. Berenice Avenue • Chicago 13, Illinois

**Hobbed Cavities
by Midland...**



EXPANDED FACILITIES

For Doing Plastic Molding Jobs EXACTLY RIGHT!



WHETHER YOU NEED

PLASTIC PARTS

FOR ELECTRICAL APPLIANCES   

 OFFICE MACHINES OR INDUSTRIAL EQUIPMENT

Special Handles and Control Knobs for

TOOLS  RADIOS  AUTOS  PLANES 

CASES FOR  CLOCKS  CAMERAS  JEWELRY

BATHROOM FIXTURES  MEDICAL ACCESSORIES 

*Or Anything Else that's a
Practical Plastic Application*

You Get the Job Done Right by

You see above some of the equipment for injection and compression molding in the new Amos plant—where customers get plastic molding jobs done the way they want them, *exactly right*.

As you go through the new Amos plant from the material and molding rooms to the die shop and finishing departments—you are impressed with all the modern equipment and all the quality controls that watch over every operation on every job. Then, when you go to the engineering department and talk with the experienced men who plan Amos jobs, you understand why customers like to do business with Amos.

From engineering to finishing, Amos does plastic molding jobs that go into many different fields. Whether it be a large or small component part for some machine or appliance—or an all-plastic product—Amos does the job completely—and *does it right*. Just send us your drawings or write us what you have in mind to be molded in plastics.

AMOS MOLDED PLASTICS • EDINBURGH, INDIANA
Division of Amos-Thompson Corporation

Amos
MOLDED PLASTICS

CUSTOM Molders of
Plastic Parts and Products

INJECTION • COMPRESSION

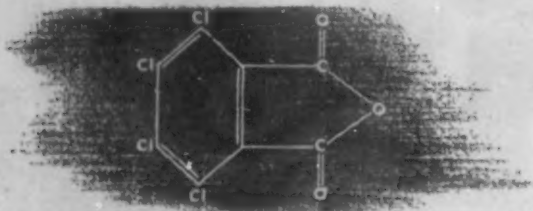


PRESENTING...

Niathal

TETRACHLORO PHTHALIC ANHYDRIDE

● NIATHAL* is fully chlorinated Phthalic Anhydride—all four hydrogen atoms being replaced by chlorine. The molecular structure of Tetrachloro Phthalic Anhydride may be represented as follows: The molecular weight of this compound is 285.9 and the chlorine content is 49.6%. It is made by a novel process for which patent protection is pending.



PROPERTIES—NIATHAL is an almost white, odorless powder. Its purity is greater than 99%, the remainder being chiefly chemically bound water. It is free-flowing and non-hygroscopic.

NIATHAL melts with very slight decomposition at 254-255°C (255°C = 491°F), as against 254.9°C for the 100% pure compound. It has an appreciable vapor pressure at elevated temperatures and particularly above its melting point. It boils at approximately 362°C (684°F).

Although our own experience indicates that NIATHAL is non-irritating and non-toxic, we recommend suitable precautions when using it for making new compounds and products.

SOLUBILITY—100 parts of water dissolves with difficulty up to 0.33 parts of NIATHAL at 20°C and about 1.6 parts at 90°C, forming the corresponding dibasic acid. A pH of about 2.0 characterizes this solution.

With caustic soda or caustic potash solutions NIATHAL readily forms the neutral alkali salts, both of which are highly soluble; about 35% aqueous solutions of these salts may be obtained at 65°C. These salts, as well as the slightly soluble acid salts, form crystalline solids. NIATHAL forms nearly insoluble salts of several common metals.

A NEW AND VERSATILE
INDUSTRIAL CHEMICAL
For Which A Manufacturing
Process Has Been Developed

NIATHAL is soluble in several organic solvents. For example, 2 to 6% solutions may be obtained at room temperature in Acetone, Benzene, and Chlorobenzene. Solubilities materially increase with elevation of temperature.

USES—Since Phthalic Anhydride has found extensive use in numerous synthetic organic chemical industries, it is predicted that the chlorinated product will also find large and varied outlets. The introduction of almost 50% chlorine into the molecule yields new and interesting properties. The chemical structure is highly stable. This fact, in combination with high melting point, suggests that compounds made from NIATHAL may be used at more elevated temperatures. High chlorine content also improves resistance to fire.



NIATHAL is suggested for use as an intermediate or compounding material in the manufacture of...

DYES • ESTERS • SYNTHETIC RUBBERS
PHARMACEUTICALS • PLASTICIZERS • INSULATING MATERIALS • FUNGICIDES • PROTECTIVE COATINGS • LUBRICANTS • SYNTHETIC RESINS.

SHIPPING CONTAINERS—NIATHAL will be shipped in fiber containers or paper-lined wooden barrels of various sizes. It is at present available only in experimental amounts. Sample on request.

*Trade Mark Registration applied for



Niagara ALKALI COMPANY

"An Essential Part Of America's Great Chemical Enterprise"

60 EAST 42nd STREET, NEW YORK 17, N. Y.

CAUSTIC POTASH • CAUSTIC SODA • PARADICHLOROBENZENE • CARBONATE OF POTASH • LIQUID CHLORINE



*before the war
during the war
—and certain to
be even better
after the war*



GAYLORD CONTAINER CORPORATION
General Offices: SAINT LOUIS

CORRUGATED AND SOLID FIBRE BOXES
FOLDING CARTONS • KRAFT GROCERY BAGS
AND SACKS • KRAFT PAPER AND SPECIALTIES

New York • Chicago • San Francisco • Atlanta • New Orleans • Jersey City • Seattle • Indianapolis • Houston • Los Angeles • Oakland • Minneapolis • Dallas • Jacksonville • Columbus • Fort Worth • Tampa • Detroit • Cincinnati • Des Moines • Oklahoma City • Greenville • Portland • St. Louis • San Antonio • Memphis • Kansas City • Milwaukee • Chattanooga • Bogalusa • Wealaco • New Haven • Appleton • Hickory • Greensboro

• BUY MORE WAR BONDS NOW •

announcing:

another outstanding resin adhesive

PENACOLITE G-1215



PENACOLITE G-1215, newest product of the Pennsylvania Coal Products Company research laboratories, is a worthy bearer of the PENACOLITE name. Unexcelled for bonding plastics, wood, rubber, metal, paper, cloth, and countless other elements, it features substantially lower cost with vastly improved performance.

In production, PENACOLITE G-1215 can be stored indefinitely, can be used without equipment changeover, and gives the easiest and quickest bond obtainable. Complete cure can be affected to meet your production speed—within two minutes if necessary, at elevated temperature.

In operation—like the other PENACOLITE room temperature setting phenolic adhesives which it complements—PENACOLITE G-1215 is heatproof . . . boilproof . . . waterproof . . . weatherproof . . . resistant to molds, fungi, acids and organic solvents.

Samples and literature are available upon request. Write: PENACOLITE Division, Pennsylvania Coal Products Company, Petrolia, Penna.

PENACOLITE G-1215 meets the Navy Bureau of Ships Specification 52G12, Army Air Force Specification 14124, and all requirements of Navy Aeronautical Specification G33 with filler content slightly above maximum.

PENNSYLVANIA COAL PRODUCTS COMPANY
PETROLIA, PENNSYLVANIA



NORTON LABORATORIES
(INCORPORATED)
CUSTOM MOULDERS OF SYNTHETIC PLASTICS
BAKELITE DUREZ
LOCKPORT, N.Y.

NORLOC
NOVELTIES

ALL AGREEMENTS ARE CONTINGENT UPON STRIKES, FIRES, ACCIDENTS OR CAUSES BEYOND OUR CONTROL.
CONTRACTS WITH AGENTS NOT VALID UNTIL APPROVED BY AN OFFICER.

September, 1945.

To The Executive Who Has No Crystal Ball:

We are on the threshold of a tremendous economic transition...a transition from a wartime to a peacetime economy...a transition that will mean prosperity for some—chaos for others.

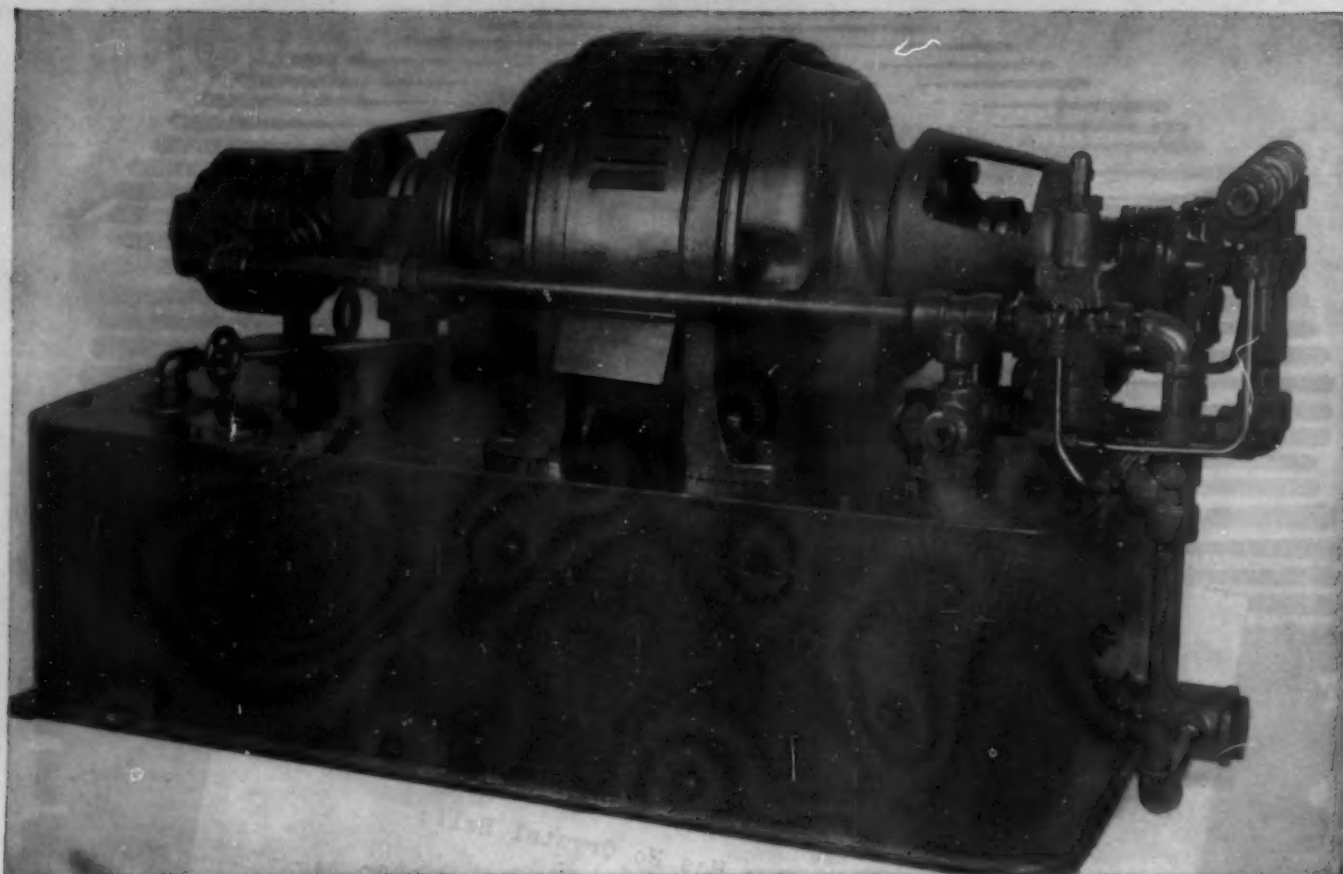
Most businessmen are willing to leave predictions of the future to the crystal gazers, relying on their own knowledge and experience—and that of others—for competent guidance.

We, at Norton, have been in this plastics molding business for the past two decades and are confident that this broad experience has taught us something which will be of unusual value to those who wish to take profitable advantage of the inevitable and sizable plastics market of the post-victory era. Our experienced engineering staff and large plant facilities are available towards helping you to that end.

Why not drop us a line? Remember, action today may mean profits tomorrow. Your inquiry will be most welcome and will receive prompt attention.

Cordially yours,

J. B. Neal
J. B. NEAL
President



HYDRAULIC POWER UNITS • 3000 P.S.I.

Packaged Assemblies Combining High Pressure Low Volume and Low Pressure High Volume Pumps and Valves for Manual and Automatic Control

**PRESSES • CALENDER ROLLS • HYDROSTATIC TESTS • ROLL BALANCING
BROACHES • PRESSURE SEALS • FLOW TESTS • BEARING FLOTATION**

Hy-Lo Hydraulic Unit

21 GPM • 3000 P.S.I.

**These units have been in extended service in Rolling Mills
• Textile Plants • Chemical Plants • Plastic Plants • Testing
Laboratories • Research Laboratories • Rubber Plants • Powdered
Metal Industry • Aviation Research • Airplane Manufacture
for Standard Equipment and Production Test Procedure**

3000 P.S.I. Pumps in Capacities of 1/2- 1- 2- 3 GPM • Hy-Lo Combinations 5 GPM and Up

Experienced Hydraulic Engineers Are Available Without Obligation

THE NEW YORK AIR BRAKE COMPANY

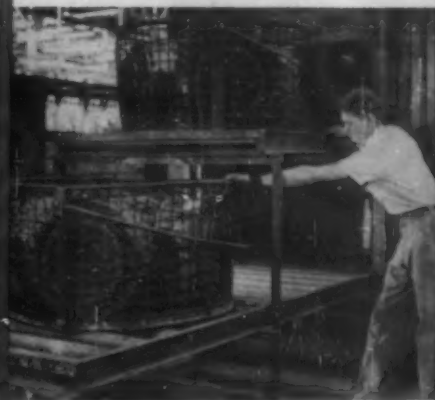
Hydraulic Division

420 LEXINGTON AVENUE, NEW YORK 17, N. Y. • FACTORIES: WATERTOWN, N. Y.

How to get higher sealing efficiency with Thalid casting sealant



1. Vapor Degreasing. Cleaning of castings received upon completion of machining operations by vapor degreasing.



2. Preheat Oven. Castings racked in baskets entering preheat oven where possible remaining degreaser fluid and oil are driven out of porosity openings.

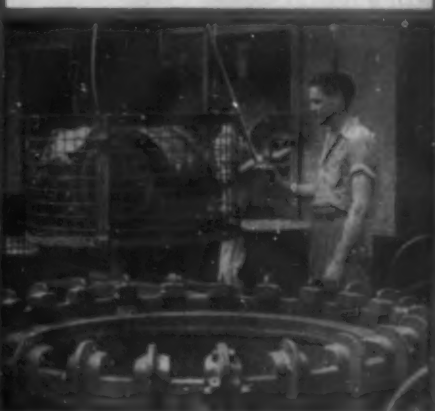


3. Impregnation. Castings draining upon removal from autoclave where they were impregnated by drawing a vacuum and then admitting solution and applying pressure. Castings must be cooled subsequent to preheat before entering autoclave.



4. Washing. Washing of castings free of impregnating solution accomplished in two steps:

- (a) Kerosene rinse. (Not shown.)
- (b) Pressure flushing of crevices and oil lines.



5. Polymerization. Castings replaced in baskets ready for insertion in steam-heated autoclave where impregnating solution in casting porosities is converted to a polymer.



6. Final Bake Oven. Baskets of castings upon removal from polymerization tank are immediately placed in Final Bake Oven. Higher temperature employed hardens polymer formed in polymerization. View shows castings emerging from Final Bake Oven.

Here is why new standards of sealing efficiency on aluminum and magnesium are being obtained today by users of this recently developed Thalid* casting sealant, product of Monsanto plastics research:

LOW VISCOSITY, enabling thorough penetration of finest pores

NO SOLVENTS, therefore no formation of vapor or air voids

RAPID POLYMERIZATION, means rapid cure at relatively low temperatures

POSITIVE ADHESION to magnesium or aluminum, with formation of a rubbery, non-porous solid in pores.

Other practical advantages of this new and proved compound of thermo-setting base resin and styrene monomer: (1) clean surfaces, (2) resistance to solvents, (3) stability under operating conditions, (4) easy handling in plant or foundry, (5) adaptability to either vacuum or positive pressure impregnation without changes in methods or equipment.

For complete technical information on Thalid casting sealants and experienced counsel in adapting them to your processes, write, wire, or phone: **MONSANTO CHEMICAL COMPANY, Plastics Division, Springfield 2, Massachusetts.**

Photos: Courtesy of Wright Aeronautical Corp.

*Reg. U.S. Pat. Off.



STURDY KUX PREFORM PRESSES



The new massive Model 65 produces preforms 3" diameter, has a 3" die fill and applies 75 tons pressure

This rugged preform press with its heavy duty, one-piece cast steel main frame will produce odd shapes as well as round preforms. The pressure applied by both top and bottom punches results in more solid, dense preforms, which have less tendency to crumble or break during handling. This new Model 65 press is built to safely withstand high pressures of up to 75 tons at top production efficiency. Choice of a complete size range of machines in both single punch models and multiple punch rotaries is also available.

WRITE DEPT. P FOR
NEW CATALOG OR
DEMONSTRATION



KUX MACHINE COMPANY

3924-44 WEST HARRISON STREET • CHICAGO 24

EACH PACKAGE ITS OWN SHOWCASE...



**new sales-appeal
for lingerie or lipstick,
face powder or files**



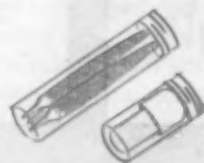
Crystal-clear cellulosic containers let buyers *see* what they buy without opening the package. Shatter-proof, feather-light, too, they enhance the saleability of a thousand diversified products and afford *adequate protection*—at surprisingly low cost! "Clearsite" types—mass-production development of Celluplastic Corporation, Newark, N. J.—are typical. Truly miniature showcases, in a variety of shapes, they help sales-leaders *stay* in the lead.

These sturdy containers may have walls as thin as one eight-thousandth of an inch. Labels are quickly printed on. Other types can be rapidly fabricated in any shape and size by injection molding, by blowing, or by forming from sheets. Which meets *your* product and price needs best?



Transparent, dust-proof
boxes for
lingerie and linens

Lightweight, sparkling
containers for
drugs and cosmetics



Tough, moisture-resistant
packages for
tools and hardware

HERCULES

CELLULOSE ACETATE
CELLULOSE NITRATE
ETHYL CELLULOSE

*For general-purpose
production plastics*

Hercules does not make plastics or molding powder, but supplies the high-quality cellulose derivatives from which they are made. For data, please write
HERCULES POWDER COMPANY 916 Market Street, Wilmington 99, Delaware.
INCORPORATED

SOFT LIGHT

and sweet music

Before the war Hemcolite Plastic Reflectors were famous for soft light. Then war demands took the entire Hemco plant capacity.

The "sweet music" of normal peacetime operations will bring Hemcolite Reflectors back to the market place again. Once more they will be used to modernize and improve tomorrow's lamps and lighting fixtures.

The know-how, special equipment and exclusive Hemcolite plastic lighting materials that characterize the Hemco plant will again be available to manufacturers of lighting fixtures as soon as conditions permit.

THE BRYANT ELECTRIC COMPANY

HEMCO PLASTICS DIVISION

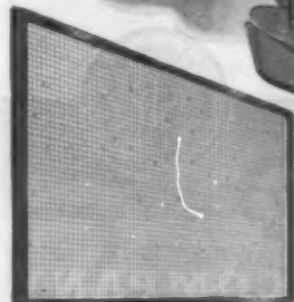
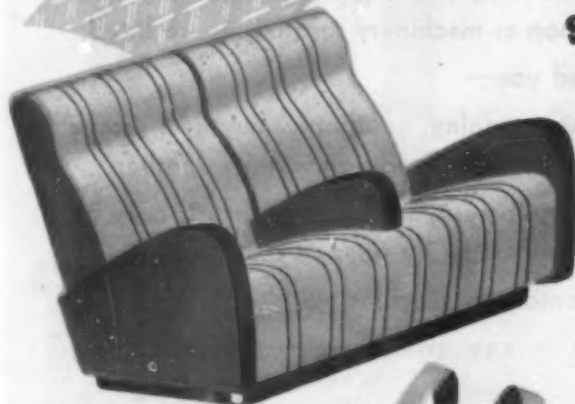
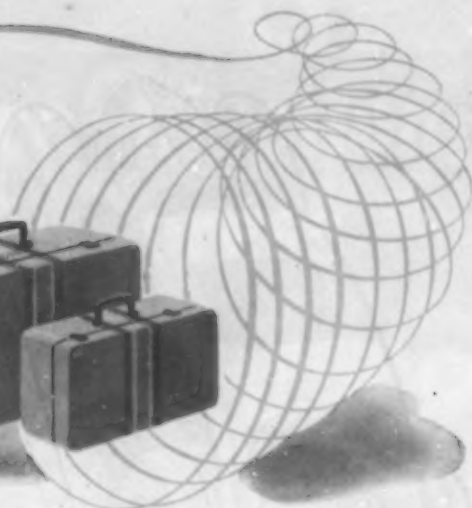
Molders of Compression and Injection Type Plastics

BRIDGEPORT 2, CONNECTICUT

A Subsidiary of Westinghouse Electric Corporation



VELON*



**stands out in beauty
stands up in wear**

Can your product stand beauty?

Now, use any color, delicate pastel, clear and bright or deeply rich, in Firestone's amazing new material — *Velon*. And these colors can be transparent, translucent, or opaque — available in an endless variety of styles, patterns and textures.

Must your product stand wear?

Velon is so durable that, installed as transportation seating, it has withstood over three years of wartime use without showing the slightest signs of wear.

Because *Velon* resists abrasion, it will not snag or scuff, and *Velon* holds its shape too, neither bagging nor stretching no matter how heavy the traffic. It is non-inflammable, non-fading, non-heat-conducting.

Must your product be cleanable?

A mere wipe with a cloth dampened in water or cleaning fluid restores *Velon*'s original beauty and freshness. Dirt cannot cling, grease gets no foothold on *Velon*'s non-porous threads — acids and alkalis cannot stain it.

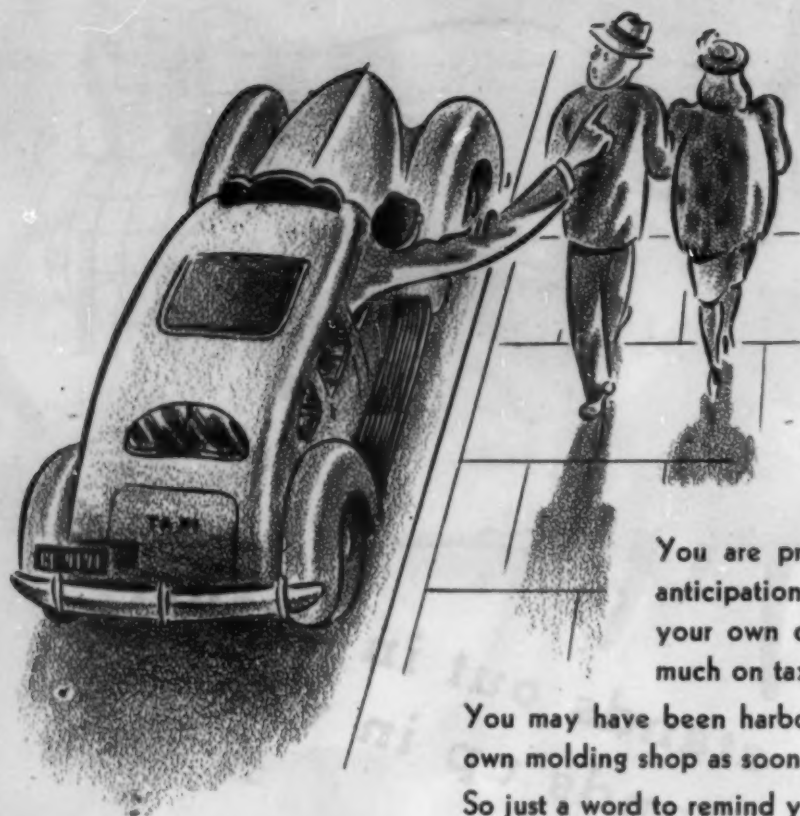
Velon is so versatile that all its uses have yet to be discovered. Already *Velon* has found enthusiastic reception as upholstery fabric for transportation seating. It can be used on indoor and outdoor furniture, for draperies, lampshades, shoes, hats, bags, belts, screening, shower curtains, decorative and protective packaging. In industry, where color plays a vital role in safety and identification, hundreds of applications have been found for *Velon*. And while almost all of this material now being made is going to the armed forces, you can plan now to use *Velon* on your product, and count on its being available to you, in the near future.



Firestone

*Trademark Pronounced VEL-ION

Listen to the Voice of Firestone Monday evenings over NBC



TAXI, SIR?

You are probably looking forward with great anticipation to the day you will be driving your own car again—instead of depending so much on taxis.

You may have been harboring the bright thought of having your own molding shop as soon as machinery restrictions are lifted.

So just a word to remind you—

Driving a car is one thing—running, equipping, buying a garage to keep that car in top operating condition is quite another.

You need a variety of equipment, some of which will only be used once a year—but will be badly needed that once.

You need a varied inventory of supplies.

You may save money in any given week—what about the other 51?

So—if you plan your own molding facilities—look deeply and carefully.

A small initial investment has a bad habit of getting out of hand, and red and black ink can easily be interchangeable.

Molding plastics is not an easy industry to master, it has a kick like a mule if not handled right.

Come out and see what is involved—or see our film "The Shape of Things to Come."



A free ride around the plastics industry is "A Ready Reference to Plastics" our little book. You may have a free copy if you are a business man or a Government employee.



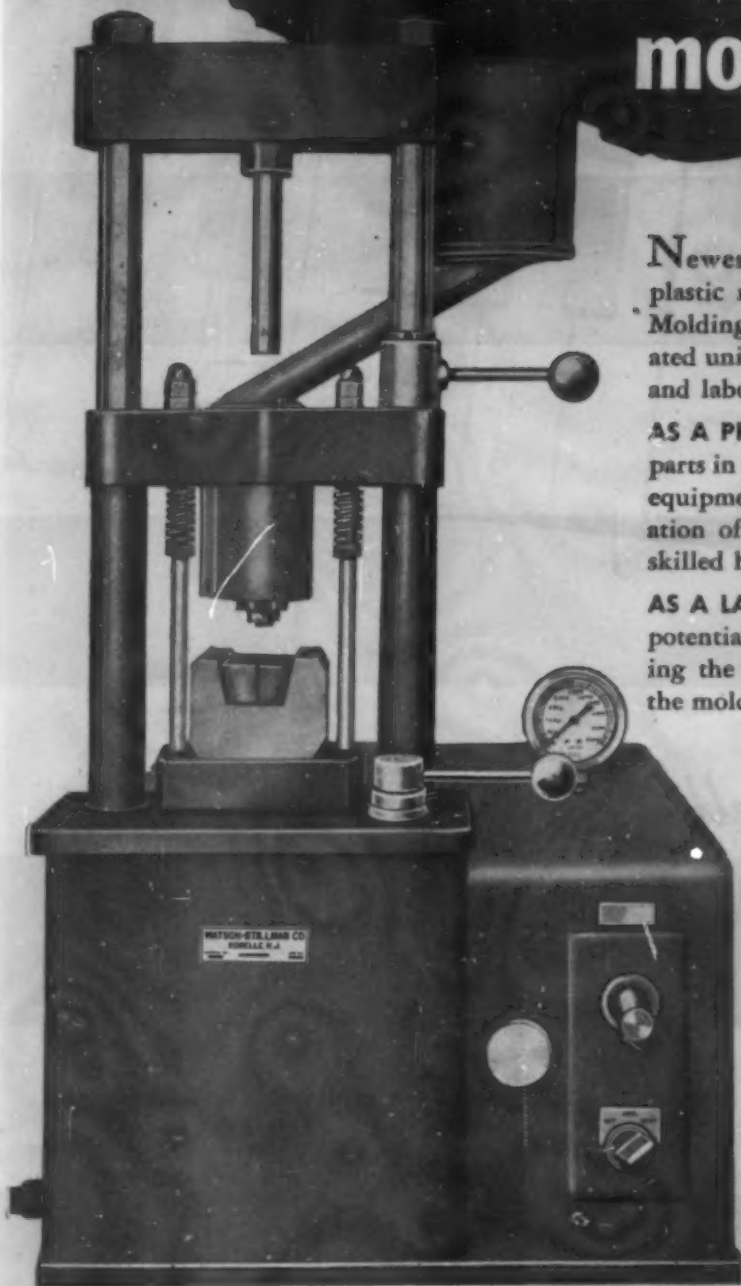
BOONTON MOLDING COMPANY

MOLDERS OF PLASTICS • PHENOLICS • UREAS • THERMO PLASTICS
BOONTON • NEW JERSEY • Tel. Boonton 8-2020

NEW YORK OFFICE

Chanin Bldg. 122 East 42nd Street, New York 17, N. Y. MUrray Hill 6-8540

W-S one-ounce injection molding press

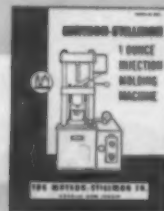


Newest addition to the Watson-Stillman line of plastic molding presses is this One-Ounce Injection Molding Machine—a self-contained, manually operated unit that is well adapted to short-run production and laboratory use.

AS A PRODUCTION UNIT—In the molding of small parts in runs too short to warrant setting up automatic equipment. The simplicity of set-up and ease of operation of this new machine permit the use of semi-skilled help.

AS A LABORATORY UNIT—For testing the molding potentiality of single-cavity dies, preparatory to making the large multiple-cavity dies, and for checking the molding characteristics of the material to be used.

Write today for Bulletin No. 623-A describing this machine. No obligation—of course. Watson-Stillman Co., Roselle, New Jersey.



WATSON-STILLMAN

HYDRAULIC MACHINERY
DIVISION

FACTORY AND MAIN OFFICE
ROSELLE, NEW JERSEY

BRANCH OFFICES

WASHINGTON, D. C.
PHILADELPHIA, PA.

NEW HAVEN, CONN.
CHICAGO, ILL.

REPRESENTATIVES

WASHINGTON, D. C. Ralph Payne (R. R. Equip.)
INDIANAPOLIS, IND. W. K. Millholland Machinery Co.
CHICAGO, ILL. E. L. Essley Machinery Co.
MILWAUKEE, WISC. E. L. Essley Machinery Co.
ST. PAUL, MINN. Anderson Machine Tool Co.
SAN FRANCISCO, CAL. Jenison Machinery Co.

PITTSBURGH, PA. Laird and Johnson
CLEVELAND, OHIO The Cleveland Duplex Machinery Co.
DETROIT, MICH. Peninsular Machinery Co.
GRAND RAPIDS, MICH. E. L. Essley Machinery Co.
LOS ANGELES, CAL. Smith Booth Usher Co.
SEATTLE, WASH. Star Machinery Co.

CANADA: Canadian Fairbanks-Morse Co., Ltd. • Branches in All Principal Cities

107



Why is Cellulose Nitrate Preferred for Piano Keys?



NIXON C/N
Cellulose Nitrate
NIXON C/A
Cellulose Acetate
NIXON E/C
Ethyl Cellulose

A piano keyboard usually receives rough usage. The individual keys must be tough and wear-resisting . . . dimensionally stable under all conditions . . . retaining their original lustre or gloss finish during a lifetime of service. Nixon C/N meets all these requirements.

NIXON NITRATION WORKS • NIXON • NEW JERSEY

REPRESENTATIVES:

New York • Chicago • Detroit • Saint Louis • Leominster

SALES AGENTS:

NORTHWEST PLASTICS INDUSTRIES

921 Terminal Sales Bldg., Portland, Oregon • 415 Fourth Cherry Bldg., Seattle, Washington

HOBBS GLASS, LTD., Canadian Distributors

Quebec • Montreal • Ottawa • Toronto • Hamilton • Brantford • London
Windsor • Winnipeg • Moose Jaw • Saskatoon • Vancouver • Victoria



Quiet



Design engineers looking for peak efficiency and long life in fractional H.P. motors, will pick a QUIET motor—A BALLENTINE MOTOR. Because only skilled craftsmanship, strict adherence to close tolerances, *precision dynamic balance* plus modern manufacturing methods and equipment can produce a truly QUIET motor. In BALLENTINE MOTORS, the engineer finds all these factors—at their best—combined with suitable mechanical and electrical design. Quiet BALLENTINE MOTORS are available in ratings from 1/1000 to 1/6 H.P.—adapted to your specific application. Write for descriptive bulletin.

BALLENTINE MOTORS

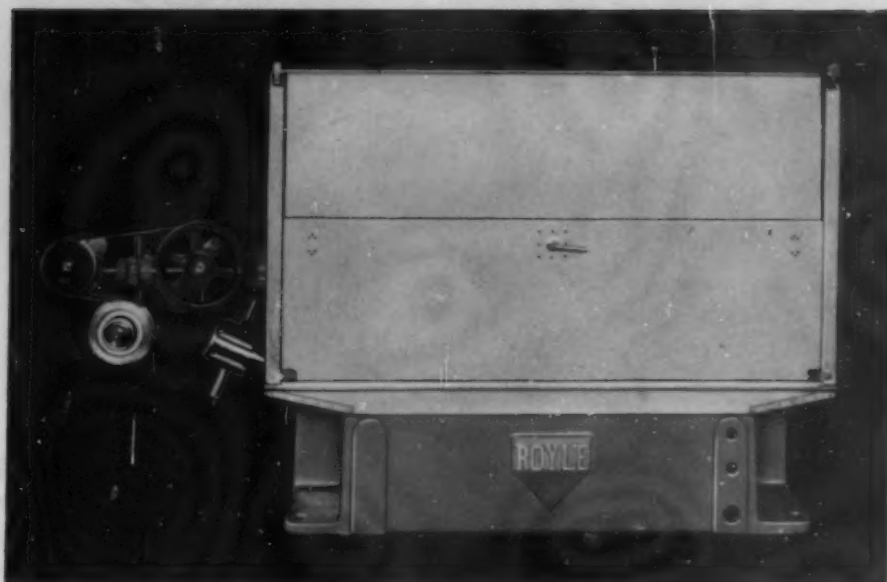
Manufactured by

RUSSELL ELECTRIC COMPANY

352 W. HURON STREET, CHICAGO 10, ILLINOIS

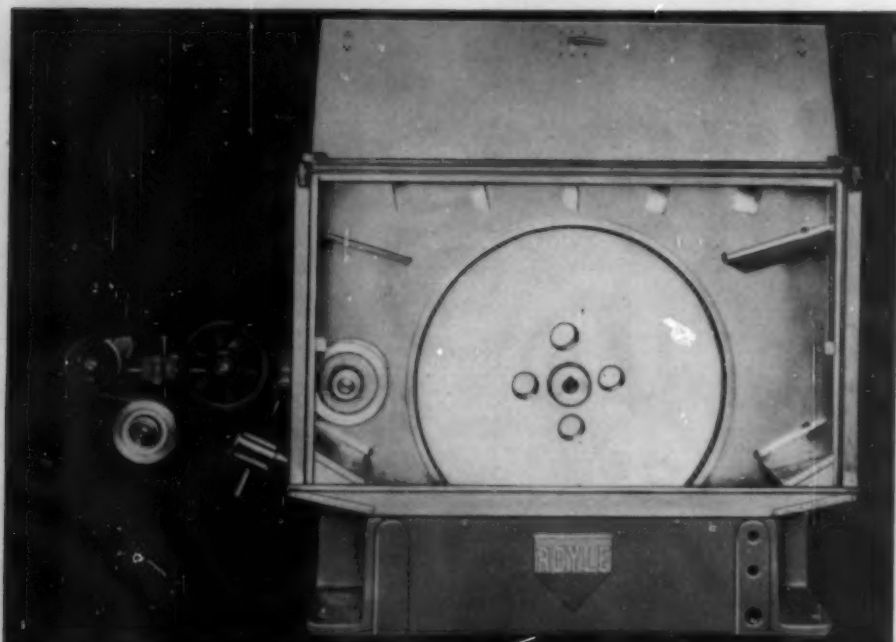
The Royle 36"

High Speed Capstan
for
Resin Insulated
Wire



CHECK THESE FEATURES

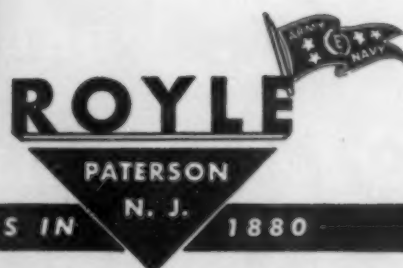
- Stainless steel watertight enclosure
- Total enclosure permits higher wire speeds
- More efficient wire puller stabilizes wire speed
- Secondary idler pulleys guide wire across capstan preventing rubbing and permitting greater quantities of wire to be cooled simultaneously
- Quiet running
- All bearings located outside of enclosure to prevent contact with water



- Built-in air wiper
- Full size folding side assures maximum accessibility
- All interior surfaces which are touched by wire or spray are of aluminum or corrosion resisting metal to withstand the chemical reaction of the various resins.

JOHN ROYLE & SONS

PIONEERED THE CONTINUOUS EXTRUSION PROCESS IN

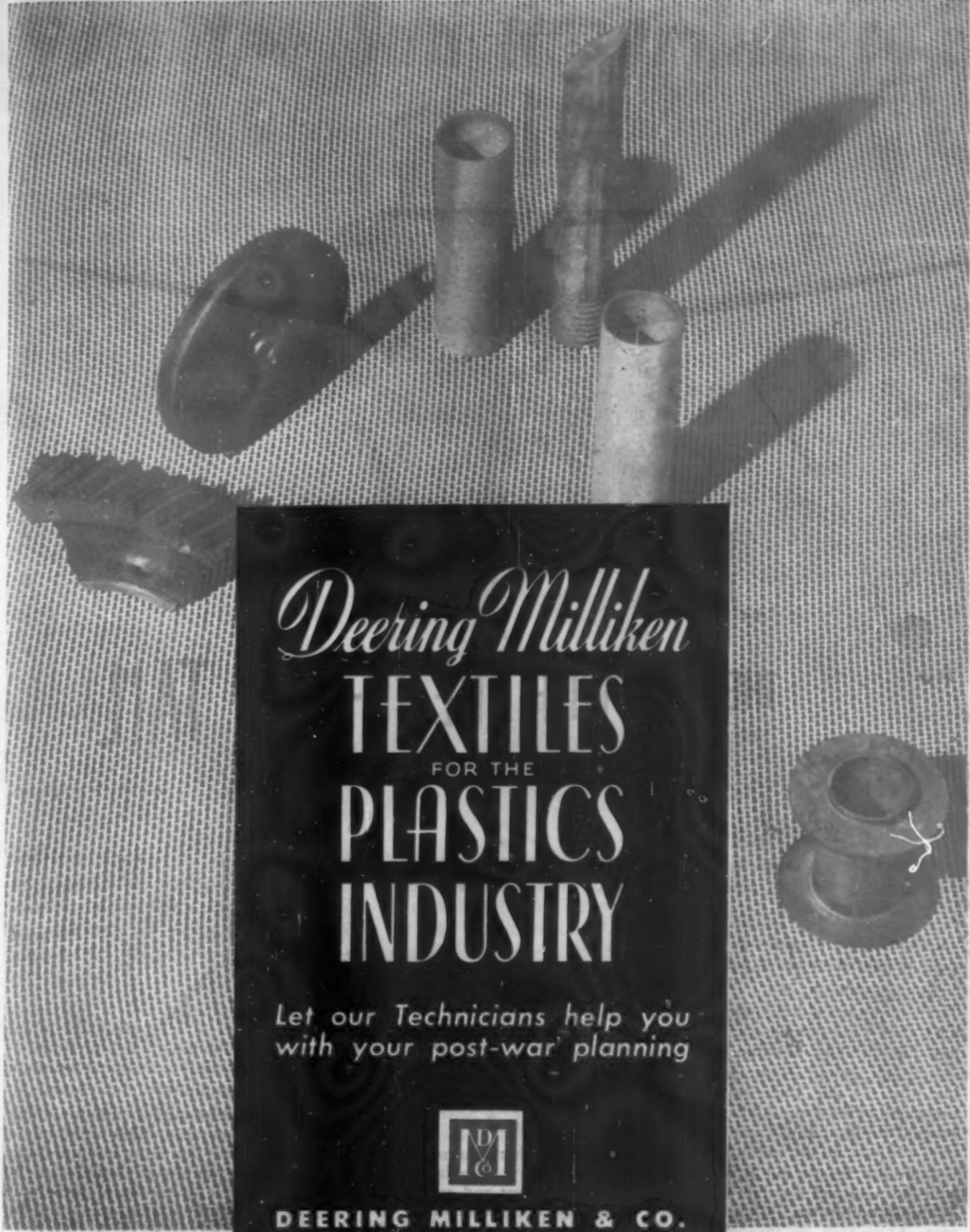


James Day (Machinery) Ltd.
London, England
Regent 2430

Home Office
B. H. Davis J. W. VanRiper
Sherwood 2-8262

Akron, Ohio
J. C. Clinefelter
University 3726

PATERSON 3, NEW JERSEY



Deering Milliken
TEXTILES
FOR THE
PLASTICS
INDUSTRY

Let our Technicians help you
with your post-war planning



DEERING MILLIKEN & CO.
INCORPORATED

240 CHURCH STREET, NEW YORK 13, N. Y.

Sales Offices:

CHICAGO	300 West Adams Street
DALLAS	503 Texas Bank Building
LOS ANGELES	111 West Sixth Street



THE BIRD WITH THE 16-MILE TAIL

The wire you see with the parachute on the end of it is a telephone wire, being payed out from a C-47 cargo plane.

Bell Telephone Laboratories, working with the Air Technical Service Command of the Army Air Forces, developed this idea. It will save precious lives and time on the battlefield.

A soldier throws out a parachute with the wire and a weight attached. The weight drops the line to the target area. From then on, through a tube

thrust out the doorway of the plane, the wire thrums out steadily — sixteen miles of it can be laid in $6\frac{2}{3}$ minutes. Isolated patrols can be linked quickly with headquarters. Jungles and mountain ranges no longer need be obstacles to communication.

This is in sharp contrast to the old, dangerous way. The laying of wire through swamps and over mountains often meant the transporting of coils on the backs of men crawling through

jungle vegetation, and in the line of sniper fire. It is reported that in one sector of the Asiatic theater alone, 41 men were killed or wounded in a single wire-laying mission.

Bell Telephone Laboratories is handling more than 1200 development projects for the Army and the Navy. When the war is over, the Laboratories goes back to its regular job — helping the Bell System bring you the finest telephone service in the world.



BELL TELEPHONE LABORATORIES

Exploring and inventing, devising and perfecting for the Armed Forces at war and for continued improvements and economies in telephone service.

Note the Sad Resemblance?



THE LITTLE GADGET is a metal insert—for *your* plastic part, perhaps. It's likewise the monkey wrench in the works of many a molding and delivery schedule. But not to us and *our* customers!

We produce inserts right in our plant. And we cut out snarls in shipping—misunderstandings about materials, methods, dimensions or tolerances—and difficulties in meshing insert and molding schedules. In fact, that resemblance we mentioned

doesn't even exist here at Kurz-Kasch.

This is another evidence of our policy of shouldering *complete* responsibility for your plastics molding job—and that goes for every step from design to delivery. We offer, too, one of the largest, best-equipped custom molding plants in the country—plus one of the oldest and most respected records in the industry for furnishing plastic parts to American industry.

Our front door is open, and we're interested in what business we can fit

in. If you have an interest in plastic parts molded by compression or transfer, let's talk it over.

"A Businessman's Guide to the Molding of Plastics"

Send for your free copy of this illustrated brochure. Just write to Dept. 7 on your letterhead and we'll send it with our compliments.



THE WAR BONDS YOU KEEP ARE THE BONDS THAT COUNT

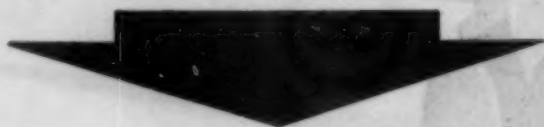
Kurz-Kasch

For over 28 years Planners and Molders in Plastics

Kurz-Kasch, Inc. 1415 South Broadway, Dayton 1, Ohio. Branch Sales Offices: New York • Chicago • Detroit • Indianapolis • Los Angeles • Dallas • St. Louis • Toronto, Canada. Export Offices: 89 Broad Street, New York City

Resemblance?

SAFETY



FIRST:

Away with rejects! Leominster Injection Molder requires only one adjustment of One screw for precise die-alignment, preventing flooding.

SECOND:

Toggle-trouble is eliminated by full-length toggle pin support — and — "Centralshaft" centralized movable plate support assures equalized pressure distribution.

THIRD:

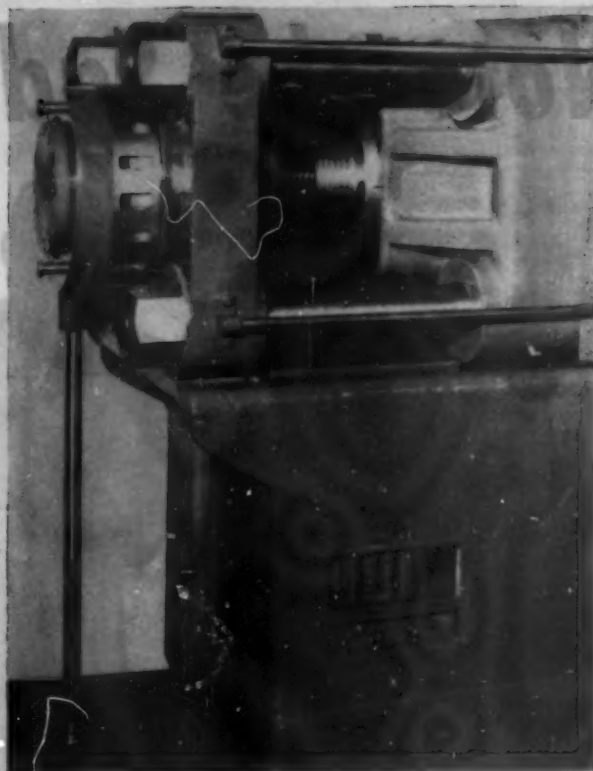
Machine cannot function when EITHER door is open, nor when either of the two independent safety factors becomes in-operative.

FOURTH:

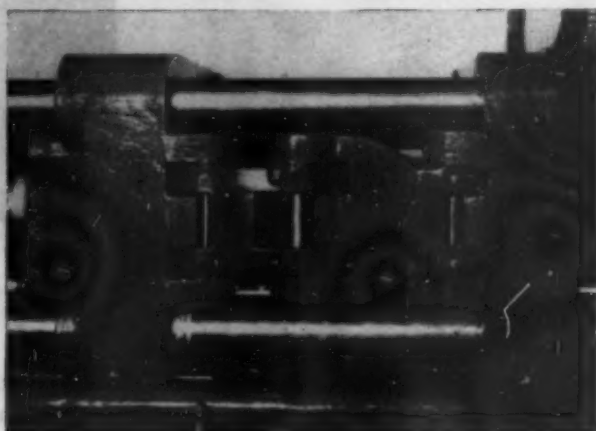
Ejection parts' erosion, cramping, breakage, are done away with by uniform thrust of the multiple knock-out pin assembly.

and FIFTH:

An efficient machine assures an efficient operator — each influences the other — for better production — and Leominster Molders are safe, sure, certain!



Single Screw Die - Alignment; A Patented Leominster Feature.



Massive Full-Length Support For Toggle Pins

Leominster Injection Molding Machine No. 5, Series 44, termed "the molder with a brain" by plastics experts and operators, is one of a comprehensive line of plastics molding machinery produced by Leominster. May we send you a recent folder describing molds, molders and granulators?

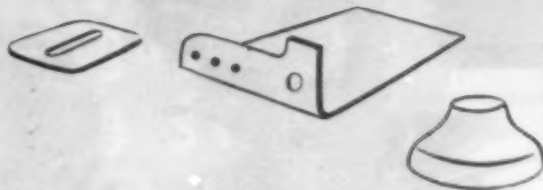
LEOMINSTER TOOL CO., Inc.

LEOMINSTER, MASSACHUSETTS

MANUFACTURERS OF MACHINES, TOOLS AND DIES FOR THE PLASTICS INDUSTRY



Impregnating Papers for Industrial Laminates



Because of Munising's continuous research in pulp and paper manufacture, specifications formerly considered impossible of attainment are now accepted as normal. And, results from producing laminating papers for varying requirements indicate definite advantages in building the paper to fit the individual need.

Munising Papers, Custom-Manufactured for Industrial Laminates, offer these characteristics:

- 1-CONTROLLED UNIFORMITY...in Density, Caliper, and Fibre Formation..to insure Uniform Absorbency.
- 2-STRENGTH in aqueous and non-aqueous solvents.

For electrical or mechanical uses, Impregnating Papers can be developed to include definite properties necessary for simplified and uninterrupted production. If yours is a problem of this type, or one where individualized paper might be the solution, may we suggest you contact us?

The Munising Paper Company

Sales and Executive Offices • 135 South La Salle Street, Chicago 3, Illinois • Pulp and Paper Mills at Munising, Michigan



MANUFACTURERS OF PRECISION MADE PULP AND PAPERS FOR MORE THAN 40 YEARS

Could you Machine this Work in 5 Simple Steps?



Photo courtesy
Parker Stamp Works, Inc.,
Hartford, Connecticut

A Milwaukee 2D Rotary Head Milling Machine milled this Walkie-Talkie part mold in 5 simple steps in a total time of 90 hours — a typical speed, economy, and accuracy performance. Here is the sequence of operations:

- 1—Strap both mold halves together in an upright position on machine table and mill "Ear" and "Mouth" sections complete.
- 2—Mill elongated sections for core guide.
- 3—Position mold blocks on machine table as illustrated, lay out and mill handle grip section complete
- 4—Mill core guide and recesses to form small pass at the "Mouth" end of molded part.
- 5—Mount core holding plate in vise and mill 3 recesses.

Total machining time — 90 hours.

Check these advantages of the Milwaukee 2D Rotary Head Milling Machine and how you can benefit from them in your own shop:

DIRECT . . . mills mold cavities in a single setup without the aid of templates or models, transmitting blueprint dimensions and outlines directly to the workpiece.

ACCURATE . . . chances for error are eliminated because there is no change in setup. Exact control of all combinations of cutting movements — possible only with this machine — transmits mathematical precision to the work.

FAST . . . initial job preparation and setup time is reduced to the minimum. Accurate performance of the machine saves operator's time and rapid production of intricate molds and dies is the result.

Write for Bulletin No. 1002C and complete information.



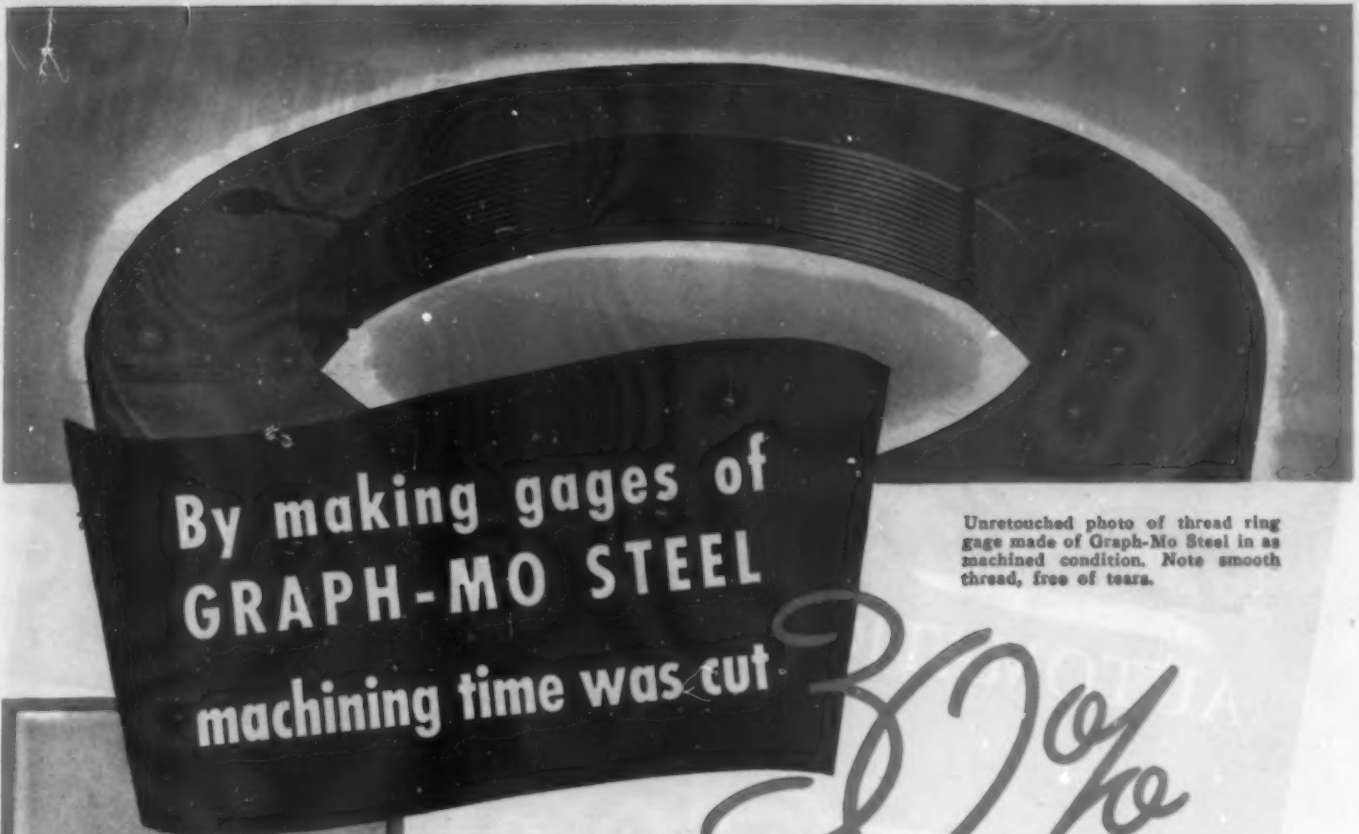
BUILDERS OF MILWAUKEE ROTARY HEAD MILLING
MACHINE • MIDGETMILL • SPEEDMILL • FACE MILL
GRINDER • AUTOMETRIC JIG BORER • CENTER SCOPE.

Kearney & Trecker

Products
CORPORATION

Milwaukee 14, Wisconsin

Subsidiary of Kearney & Trecker Corporation



By making gages of
GRAPH-MO STEEL
machining time was cut

Unretouched photo of thread ring gage made of Graph-Mo Steel in as machined condition. Note smooth thread, free of tears.

30%

By using Graph-Mo Steel Perfex Gage and Tool Co., Detroit, Michigan have increased production of thread ring gages without compromising the high standard of quality they have constantly maintained for their products.

The free machining qualities of Graph-Mo Steel enabled Perfex to produce a good, clean thread, free from tears which reduced lapping and saved 30% in machining time. This enabled Perfex to machine three gages in the time formerly required for one! As a consequence they use Graph-Mo Steel for all ring gages up to 72 pitch.

Graph-Mo is an oil hardening non-deforming tool steel and is one of the five performance-proven Timken Graphitic Steels. These steels contain free graphite which gives them remarkable free machining qualities, high resistance to wear and good frictional properties with less tendency for pick up and scoring than with competing tool steel grades.

Take advantage of the superior qualities of Timken Graphitic Steels. Use them to speed production and to give tools and dies a longer life. For complete details about these steels write to The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio.

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
GRAPHITIC STEELS



STEAM GENERATOR?

Dutton ECONOTHERM AUTOMATIC STEAM GENERATOR

No other steam generator gives you such a great combination of engineered features all in one automatically operated, self-contained unit—you can depend on the Econotherm for outstanding economy, efficiency, long-life and cleanliness. The result of 65 years experience!

AUTOMATIC OPERATION: Every instrument and control necessary for fully automatic operation with minimum supervision.

★ **BURNERS:** Oil or gas firing. Automatic with electric ignition—maximum heat output with minimum fuel consumption.

★ **ROTARY COMBUSTION:** An exclusive Dutton principle gives greatly increased firing rate and quicker steaming to meet maximum demands instantly.

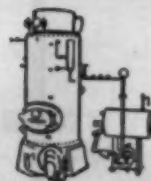
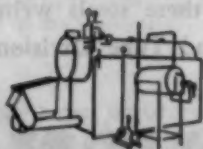
★ **BOILER FEED PUMP AND CONDENSATE RETURN SYSTEM:** Integral part of unit with condensate receiver enclosed in casing. Automatically maintains normal water level and provides make-up water as required.

★ **THREE PASS, INDUCED DRAFT SYSTEM:** Guarantees faster steam, uniform circulation, and good quality steam without variations in pressure or changes in water level. All gases scavenged. No stack necessary—only small vent pipe to carry flue gases through roof.

★ **INSULATION:** Boiler shell completely insulated with rock wool blanket and covered with steel lagging.

★ **STREAMLINED CASING:** Enclosed entire boiler with removable panels for quick access to vital parts. All wiring and piping done at factory—a great saving in installation costs.

DUTTON ECONOMIST
HIGH PRESSURE BOILERS



DUTTON AUTOMATIC
VERTICAL BOILERS

PRESSURE VESSELS • HEAT EXCHANGERS • CONDENSERS

THE C. H. DUTTON COMPANY • 618 GIBSON STREET • KALAMAZOO, MICHIGAN

PLASTIN*

AND ITS REMARKABLE
RESISTANCE TO AGING



PLASTIN IS NEW. Ratings of "excellent" have consistently resulted from laboratory aging tests. Of the thousands of yards of Plastin which have been in actual use, none has shown any sign of failure due to aging.

Add Plastin's unusual thermal characteristics, high strength, and complete moisture-vapor resistance and you will readily understand why it is hailed as a great victory in the battle against corrosion.

To learn more about Plastin, which surpasses all Type I barrier requirements for maximum load limits under Method II packaging, ask for "An Introduction to Plastin". This file-size folder contains a description and small samples.

PLASTIC FILM CORPORATION

PHONE: LEXINGTON 2-5458 • 475 FIFTH AVE., NEW YORK 17, N.Y.

PLASTIC FILM CORPORATION
475 Fifth Avenue
New York 17, New York

Gentlemen:

Please send a free copy of "An Introduction to Plastin" to:

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

*Patents Pending
Trade Mark Reg. U.S. Pat. Off.

**FILL OUT AND
MAIL TODAY!**



The "Setting Sun..."



...means a new day for luxuries!

Molded plastics—by solving innumerable vitally-important problems in war time industry—have won recognition as a definite factor in efficient, economical production. Plastics possess basic values not apparent in other materials . . . offer simpler methods and lower costs in many phases of manufacture.

These factors provide a means for industry to meet tomorrow . . . with a solution to the changing requirements of industry—and the answer to the demands for new

products. The economy of molded plastics will be of particular significance in more intense competition, when present restrictions are withdrawn.

MACK MOLDING—with three completely equipped plants—is qualified to advise on molded plastics. The experience of two generations in custom molding for industry, is at your disposal. Engineers "brought up" in this specialized field, are available for recommendations relative to design and production.

The new 8-page brochure "Custom Molders to Industry" will be sent

free on request on your company letterhead. A brief comprehensive treatise on plastics, and the broad possibilities for product betterment, may prove helpful in effecting greater consumer acceptance. Write to Mack Molding Company, Inc., 120 Main Street, Wayne, N.J.

Mack
MOLDED
EXCELLENCE



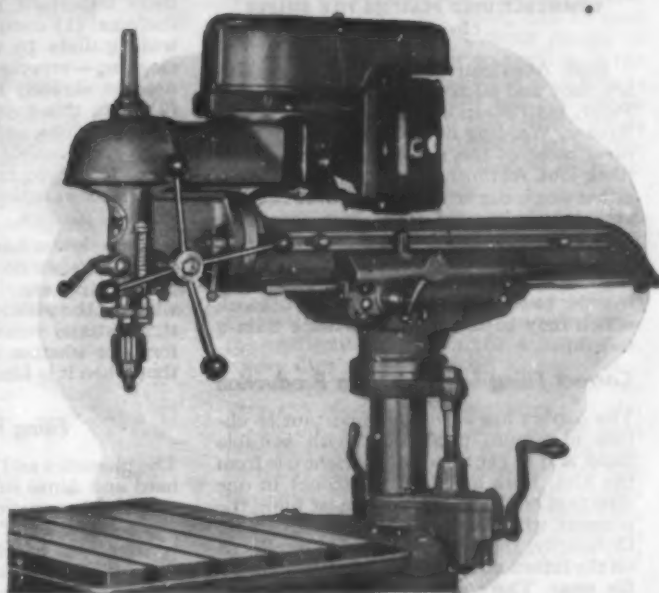
SALES OFFICES: NEW YORK CITY, CHICAGO, DETROIT, INDIANAPOLIS, BOSTON & ST. LOUIS



Walker-Turner RADIAL DRILL

The head on a Walker-Turner Radial Drill tilts to 45° in either direction. No need for angle vises and special set-ups in drilling, reaming and tapping angled holes. It speeds output, lowers production costs, improves machining flexibility.

The drill head operates anywhere within a 62" circle. Jackshaft assembly gives 16 spindle speeds from 160 to 8200 r.p.m. Has all the job-tested refinements of the Walker-Turner Drill Head for extra ruggedness, smoother running, easier operation. Write for detailed information today.



WALKER-TURNER COMPANY, INC. • Plainfield, New Jersey

PRICE \$346.50

Guard Extra
(Slightly higher west of Rockies
and in Canada)



MACHINE TOOLS

DRILL PRESSES — HAND AND POWER FEED • RADIAL DRILLS
METAL-CUTTING BAND SAWS • POLISHING LATHES • FLEXIBLE SHAFT MACHINES
RADIAL CUT-OFF MACHINES FOR METAL • MOTORS • BELT & DISC SURFACERS

THE NICHOLSON "FIRST READER" ON PLASTICS FILING

By WILLIAM N. DUDLEY

Research Department

NICHOLSON FILE CO., Providence, R. I.

FILES are very important tools for finishing molded plastics parts and for beveling, smoothing, burring and fitting the edges and corners of plastic sheets. In finishing plastics, files are used to remove the flash and for burring the parts after machining operations such as drilling and tapping.

The size and shape of file best suited for a particular job are determined by the size, shape or contour of the part to be filed. The cut, or number of teeth per inch, is generally governed by the requirements as to finish and by the type of plastic to be filed.

Much of the filing done on plastics is hand filing, so that the most commonly required standard file sizes used are 6", 8" and 10". Larger sizes are used on such units as aircraft wing and fuselage forming dies or on plastic sheets and resin-bonded plywoods. Smaller sizes of files, usually in Swiss Pattern type, are often needed on small intricate instrument parts.



Both American and Swiss Pattern files are used and such shapes as Mill or Flat, Pillar, Half Round, Round, Square, Three Square, Warding and Knife generally will meet most of the requirements of plastic filing jobs. As finish is relatively important, either single cut or the finer double cut files are commonly used. There are occasions, such as the filing of heavy industrial moldings, often made of asbestos or fiber filled materials, where the coarser cuts are used in order to effect the quick removal of stock which may be of more importance than a fine finish.

Correct Filing for Maximum Production

The correct use of files is important to obtain maximum production with suitable finish and to get the most efficient use from the files. Files are designed to cut in one direction only, therefore for most filing the pressure stroke should be in that direction. Ordinarily, the pressure should be relieved on the return stroke to prevent unnecessary file wear. There are occasions, as on fine, intricate parts, where a steady pressure on both cutting and return stroke results in a little better finish. Steady pressure is also used when cleaning out dead-end holes and slots. It is economical to use as much of the file surface as possible, both length and width, so that the file will wear uniformly

and not become dulled in one place while the rest of the teeth are sharp.

Flash removal and finishing of molded plastics present a variety of problems. Not only do different plastics have varying qualities of hardness and brittleness, but frequently there are recesses to be reached, corners and angles to be cleared out, bevels to be trued, slots or notches to be smoothed up or enlarged, holes to be reamed out and working fits to be made. Much of the filing is to remove the flash lines that are prevalent on all compression molded articles where there is a division between sections of the mold construction. Slightly imperfect matching of the mold sections produces a flash line which becomes increasingly heavier as the mold wears through continued use. In compression molding, the filing procedure is largely determined by the ultimate purpose of the part and the significance of a smoothly finished surface. Flash lines concealed from view require nothing more than a simple filing operation, using the coarser files to remove the flash as quickly as possible.

Although plastics of different types may vary in their properties, there is one characteristic that is common to most all types—their abrasive action on file teeth as on other cutting tools as well. In many cases, regular general purpose files give satisfactory results, but on production jobs where considerable filing is done it is better to use files that have been designed for use on plastics. Files for plastics should have these important individual features: (1) comparatively wide gullets to minimize clogging—especially when used on shreddy materials; (2) high, thin-topped teeth for fast cutting and to maintain serviceable cutting edges for a long time under the abrasive action of most types of plastics.

The relative hardness of the plastic has a great deal to do with the selection of the proper file cut. It makes a difference whether the plastic is hard and brittle with the material removed in powder or dust form, or whether it is soft and gummy so that when it is filed it is removed in shreds.

Filing Hard Plastics

The phenolics and ureas have an extremely hard and dense surface and when filed the material is removed in the form of a light powder or dust. These plastics are characterized by a brittle flash. When filing the flash, the best practice is to break the flash towards a solid portion rather than away from the main body to prevent chipping of the finished piece. The file is used to best advantage when pushed with a firm stroke to break off the flash close to the body and then removing the flash down to the line desired. File marks on thermosetting plastics can be kept almost indistin-

guishable and frequently no additional finishing operation is required, or at the most a wiping of the filed surface with an oily cloth to bring out the luster.

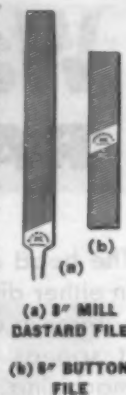
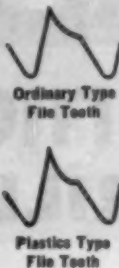
Generally, very little difficulty is experienced with files clogging up on these harder plastics. Filings will collect in the teeth but they are easily removed by brushing or by rapping the file on a wood block or on the bench top.

"Dry" Files for Plastics

New files ordinarily have a light coating of oil on their surface as a rust preventive. If there is a tendency for the filings, which are light and powdery, to adhere to the teeth or collect in the gullets because of the oil film, the file can be chalked up and then brushed to remove the oil film. This is done by rubbing the surface of the file with a piece of chalk. The chalk fills the spaces between the teeth and absorbs the oil. The chalk and oil are then removed by brushing the file, leaving a dry surface free of oil. Files for plastics may be ordered without the light coating of oil. When ordering such files, it should be specified that the files are to be furnished with a "dry finish."

Files for Flash Removal

Mill files in the Bastard and Western cuts are used extensively to remove the flash from flat or convex surfaces of molded parts, and on the corners and edges of sheets to remove the burrs from previous sawing operations or for beveling the corners. One of the most widely used files is the 8" Mill Bastard. The Western cut is slightly coarser than the Bastard cut. These are relatively fine single cut files and will leave a very good finish, yet quickly remove light flash and burrs. Special plastics files are also manufactured. One type of special plastics file is a Double Ender file that is cut from the ends towards the center, thus providing four filing surfaces. No handles are required with this type of file. These Double Ender files are generally made from steel having either Mill or Warding cross section and usually are single cut. One type of such file is designated as a Button file and is made in lengths from 6" to 10". Half Round files in sizes from 6" to 8" are used on concave surfaces. Both American and Swiss Pattern files are used in the degree of coarseness necessary to meet the requirements as to stock removal and finish. Various shapes of Swiss Pattern files in cuts from No. 00 to No. 4 are used for filing small, intricate moldings. These various shapes of small files are necessary frequently because of narrow quarters or the inaccessibility of the surfaces to be filed. Round and Half Round files are used for



NICHOLSON FILES

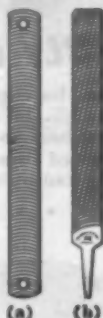
FOR EVERY PURPOSE



cleaning out holes or slots with rounded surfaces. Knife and Warding files are used to reach down between flutes or into other narrow slots and grooves.

Filing Large Areas

When large areas are filed or when the corners and edges of large sheets are to be beveled, Curved Tooth files provide an excellent tool. These files are fast cutting but still leave an excellent finish. They are relatively coarse files having a series of curved teeth which are *milled* in, not cut. They are available either in flexible or rigid types and in different degrees of coarseness. Curved Tooth files can be used for filing plastics provided conditions permit having a sufficient number of teeth in contact with the surface filed so that the sharp, keen teeth do not "dig in" too deeply to make smooth, even strokes. These Milled Tooth files can be used for filing lengthways on the corners and edges of sheets or on other narrow surfaces provided a sufficient number of teeth are in contact with the work.



(a) MILLED TOOTH FILE (flexible type)
(b) SUPER SHEAR FILE

Filing Hard Plastics

The filing of the hard or thermosetting plastics involves few serious problems limiting the selection of files. A file of convenient size, in the cut necessary to give the proper combination of stock removal and finish, can generally be used without any difficulty. In removing light flash, a rapid, light, sweeping stroke is all that is required.

Filing Soft Plastics

From the viewpoint of filing, the thermoplastics can be divided into two groups: those that are relatively very soft, such as the acetates and butyrates, and those that are somewhat harder yet considerably softer than the thermosetting phenolics and ureas. The latter group includes the vinyls, acrylics and the styrenes.

The thermoplastics are characterized by a rough, rubbery flash that has a tendency to seize and gum if heated by the cutting action. The flash cannot be easily broken but it can be bent in against the body portion and then filed through close to the line.

In filing the very soft thermoplastics, the fine cuts of files should be avoided because of the tendency for the teeth to become clogged up. Such files as Mill Bastard (single cut) or Flat and Half Round Bastard (double cut), which can be used on the hard plastics without any difficulty at all, are apt to become filled up with the shreddy material removed from the very soft plastics.

The best types of files for use on these soft plastics are coarse, single cut, diagonal tooth files in either Flat or Half Round shapes. The teeth should be cut on an angle of from 35 to 45 degrees. The combination of the coarse cut and the long angle provides a self-cleaning feature which makes files of this type well suited for filing the

very soft plastics. Because of the long angle of the cut and the relatively wide spacing of the teeth, the tendency is for the shreddy material to be pushed out from between the teeth. The file should be held at an angle of about 45 degrees and used with a long shearing or sweeping stroke toward the right. Files of this type have the following advantages: (1) coarseness of cut minimizes clogging; (2) fast cutting even when used with very light pressure; and (3) good finish. Although Curved Tooth files have many applications on plastics that are somewhat harder than the acetates, they are not recommended for filing the very soft plastics. Because of the curved teeth, it is difficult to maintain the proper angle at which to hold the file in relation to the work.

The vinyls, acrylics and styrenes are sufficiently harder than the very soft acetates so that relatively little trouble is experienced with the file teeth clogging up. Where it can be done, it is better to avoid using the finer cuts and, if they are used, light pressure should be used to minimize any tendency towards clogging. These plastics are easily filed and, except for avoiding the finer cuts where possible, the same principles in selecting files can be used as with the harder thermosetting plastics. Super-Shear files (illustrated) are very satisfactory for use on this group of plastics.

There are also some finishing jobs on the soft plastics where a scraper can be used to good advantage. Three Square ground scrapers remove flash effectively and are sometimes used on the harder plastics as well.

Filing Laminates

Laminates are usually formed with synthetic resins of the phenol-formaldehyde type, with various materials being used for filler. The properties of the filler materials determine to a considerable extent the properties of the resultant laminate. Much of the filing done is on the corners and edges of sheets. Any of the standard cuts of files can be used, but with the coarser cuts it is advisable not to file "off" sharp corners and edges as this is apt to result in some delamination of the layers at the corners of the edges. In filing across laminations, the direction of filing should be such that it tends to press the lamination together. The filing of laminated sheets is generally for the purpose of smoothing up corners of sawed sheets, beveling corners or burring drilled or punched holes. Filing is oftentimes required in the fitting of panels.

Mill Bastard or Milled Tooth files are commonly used on the corners and edges of sheets for beveling or removing burrs left from sawing operations; Flat or Half



SUPER-SHEAR FILE APPLICATION ON EDGE WORK—about 45° angle (curved tooth about 28°)



Round files for fitting panels; Half Round and Round files for burring drilled or punched holes and other shapes and cuts.

Filing Impregnated Plywoods

These plywoods consist of multiple layers of relatively thin veneers which are impregnated with a resin and then super-pressed. This type of product is hard, tough and dense, and the resin with which the wood fibers are impregnated has an abrasive action on the file teeth. Best results will be obtained by using files that have been prepared for use on plastics. The file teeth will become filled with light, fluffy wood dust, but this can be very easily removed when it accumulates sufficiently to interfere with the cutting of the file.

Any of the regular cuts may be used, but it is recommended that the coarser cuts be used wherever possible. Double cut Bastard files in any of the common shapes and sizes will leave a good finish and remove material much faster than the finer cuts. Such files as 12" Flat or Half Round Bastard will produce a very good finish. The finer cuts leave a very smooth finish and single cut files, such as Mill Bastard, leave almost a polished surface.

When large surfaces are filed, Curved Tooth files are recommended for both stock removal and finish. These files should be used in the standard cut in either rigid or flexible types. Flexible files mounted in a holder are especially effective. The sharp, keen teeth of these files remove the material in the form of light shaving. For many operations on the impregnated plywoods, these Curved Tooth files are unexcelled.

As on other laminated plastics, care must be taken when filing "off the edge" especially with the coarser files. Mill files, which are used for beveling sharp corners and for producing a very fine finish, can be used for filing off the edge without danger of causing delamination or splintering of the outside layers of veneer. Even such files as 10" or 12" Flat Bastard will not give a great deal of trouble in this respect unless excessive pressures are used; but, in general, wherever it can be done, it is preferable to file onto the edge.

In selecting files for use on plastic materials, it should be borne in mind that the same principles apply as regards size and shape as on any filing job. On the hard plastics, practically any cut may be used that will meet the requirements as to stock removal and finish. On the soft plastics, coarse files should be used wherever possible with the finer cuts avoided on the very soft plastics. The laminates and plywoods are somewhat similar to the hard plastics in regards to the selection of files. In many cases, general purpose files will be found satisfactory, but better results can be expected from files that have been made expressly for filing plastic materials and have the proper tooth structure and necessary keenness.

FREE REPRINTS of this and the preceding pages are available to plastic products managements. State quantity desired. Address NICHOLSON FILE CO., 47 ACORN ST., PROVIDENCE 1, R. I.

(In Canada, Port Hope, Ont.)

NICHOLSON FILES

FOR EVERY PURPOSE





BURRS NO LONGER SNAG!

Before Phillips Recessed Head Screws were used for trim and seat assembly in this motor bus, burrs on slotted screws snagged passengers' clothing, caused many nuisance complaints. In spite of extra time for slow hand driving, and smoothing heads, some burrs got by.



NO ASSEMBLY LAG!

With Phillips Screws, burr-trouble ended, and savings began—as much as 40% in assembly time and labor, because power driving became practical. Also saved was the time formerly wasted disassembling, refinishing, and reassembling parts scarred by driver skids.



PLANS GET O.K. TAG!

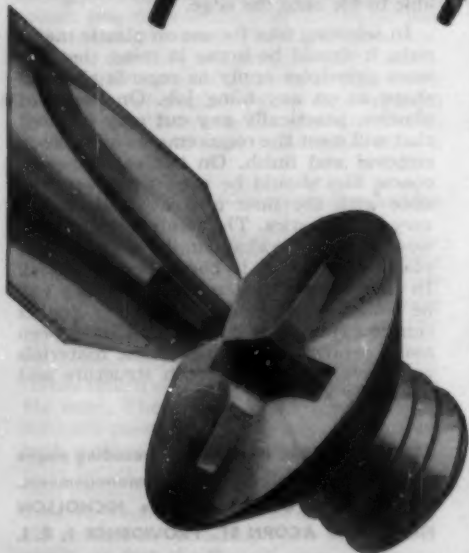
Because Phillips Recessed Head Screws take heavier driving pressures without danger of burring, driver skids, or slant driving, fastenings are stronger, more rigid than with slotted screws. Designers are freed of slotted head handicaps, can often reduce number of screws needed.



APPROVAL'S "IN THE BAG"!

Burr-free Phillips Screws are not only kind to clothing... the Recessed Head on exposed surfaces looks better, blends with the practical smartness of modern design. Give your product this cost-trimming, customer pleasing sales appeal!

It's Phillips... the engineered recess!



In the Phillips Recess, mechanical principles are so correctly applied that every angle, plane, and dimension contributes fully to screw-driving efficiency.

... It's the exact pitch of the angles that eliminates driver skids.

... It's the engineered design of the 16 planes that makes it easy to apply full turning power—without reaming.

... It's the "just-right" depth of recess that enables Phillips Screw Heads to take heaviest driving pressures.

With such precise engineering, is it any wonder that Phillips Screws speed driving as much as 50%—cut costs correspondingly?

To give workers a chance to do their best, give them faster, easier-driving Phillips Recessed Head Screws. Plan Phillips Screws into your product now.

PHILLIPS *Recessed Head* SCREWS

WOOD SCREWS • MACHINE SCREWS • SELF-TAPPING SCREWS • STOVE BOLTS

Made in all sizes, types and head styles

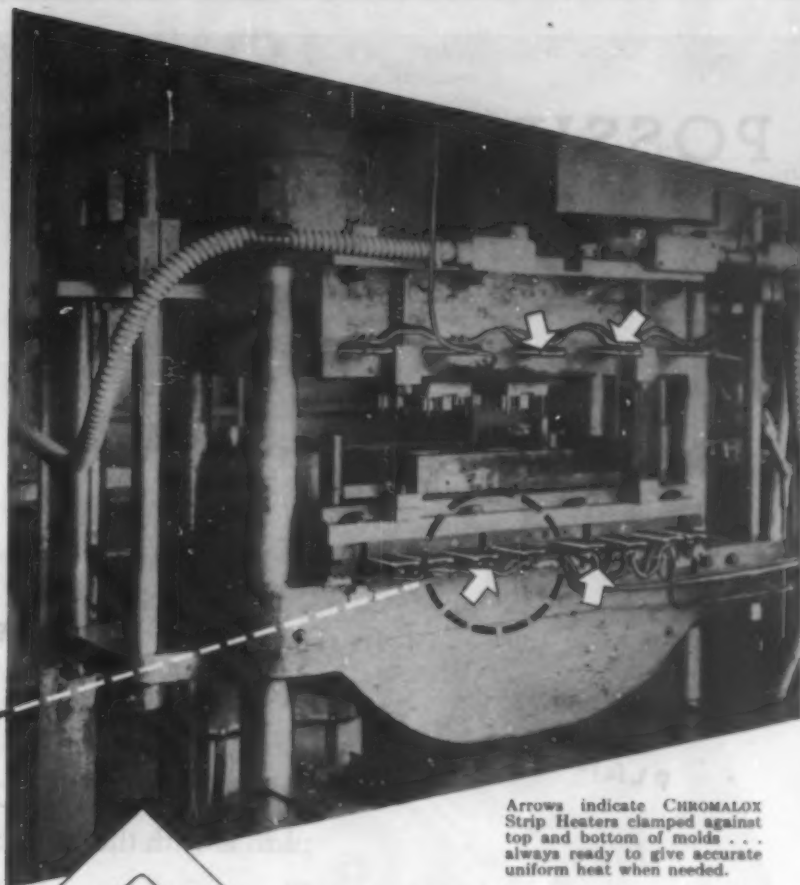
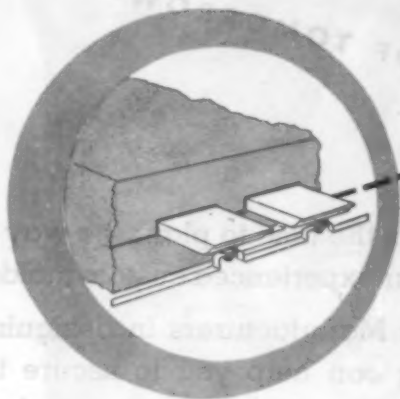
25 SOURCES

American Screw Co., Providence, R. I.
Atlantic Screw Works, Hartford, Conn.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
General Screw Mfg. Co., Chicago, Ill.

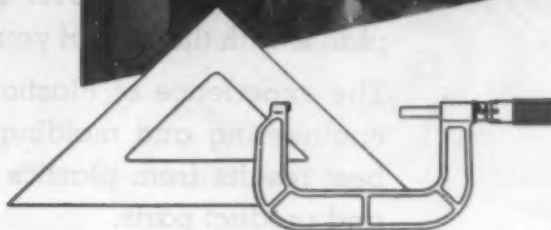
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
Manufacturers Screw Products, Chicago, Ill.
Milford Rivet and Machine Co., Milford, Conn.
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.

Phell Manufacturing Co., Chicago, Ill.
Reading Screw Co., Norristown, Pa.
Russell Burdall & Ward Bolt & Nut Co., Port Chester, N. Y.
Sevill Manufacturing Co., Waterville, Conn.
Shakproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
The Steel Company of Canada Ltd., Hamilton, Canada
Wolverine Bolt Co., Detroit, Mich.

Faster, better,
plastic molding with
CHROMALOX
electric heat



Arrows indicate CHROMALOX Strip Heaters clamped against top and bottom of molds . . . always ready to give accurate uniform heat when needed.



This 100-ton molding press in a tool manufacturing plant illustrates the practical application of CHROMALOX Electric Heaters for the heating of plastic molds.

The CHROMALOX Electric Strip Heaters used on this job were easy and economical to install. Heat is obtainable at short notice and thermostatically controlled to any temperature. There is practically no maintenance problem.

When in operation on an 8-hour day, the molds on this press cost only 8.5¢ per hour to heat electrically with CHROMALOX Strip Heaters.

Electric heat is adaptable to all types of molding presses— injection and extrusion . . . and no doubt you have other heating problems too for which CHROMALOX offers the ideal solution. Consult your CHROMALOX Application Engineer. He'll gladly tell you how you can benefit by using electric heat.

Says Factory Manager of Company "X"
... using this 100-ton press:

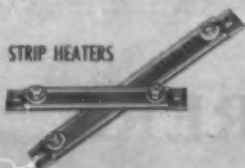
"... due to economy of operation, very accurate control of temperature, absolute cleanliness and freedom from humidity we would not consider changing to any other heating method."



Send for this booklet

It illustrates many practical examples of the applications of electric heat to industrial use and gives the address of your nearest CHROMALOX Application Engineer.

Edwin L. Wiegand Co.
7503 Thomas Blvd. Pittsburgh 8, Pa.



STRIP HEATERS



RING HEATERS



CARTRIDGE HEATERS



IMMERSION HEATERS



FINSTRIP HEATERS

CHROMALOX — "Electric Heating at its Best!"

POSSIBILITIES IN PLASTICS

PLASTIC MANUFACTURERS
INCORPORATED
PM STAMFORD, CONN.

PLAN TODAY FOR THE PLASTIC USES OF TOMORROW—

TODAY is the time to plan; the way to plan is with the help of your experienced custom molder. The experience of Plastic Manufacturers in designing, engineering and molding can help you to secure the best results from plastics for your peacetime products and product parts.

Each of the many plastic materials has its own group of properties to recommend it for specific applications and conditions of service. The material and the method of molding must be determined with an understanding of plastics performance and requirements of your product.

To get the fullest benefit from plastics, consult with us during your early planning. Perhaps product design should be changed to permit savings in cost of dies, or to provide closer tolerances or greater strength. Perhaps plastics combined with metals may solve a problem for you. We have developed special techniques in this work that may result to your profit.

For information on our services, in convenient reference form, write for Folder File MP9.



COMPLETE SERVICES FROM
DESIGN TO ASSEMBLY

MOLD MAKING

INJECTION MOLDING

TRANSFER MOLDING

COMPRESSION MOLDING

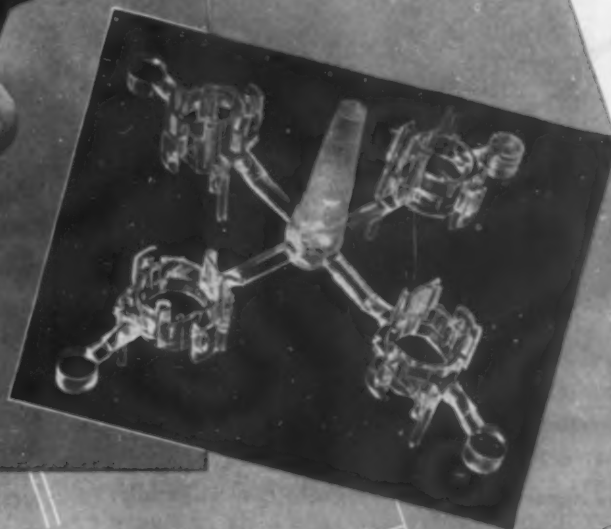
PLASTIC MANUFACTURERS

INCORPORATED

STAMFORD, CONNECTICUT

Representatives: DETROIT 2-805-06 New Center Bldg. • LOS ANGELES 35-1440 So. Robertson Blvd.

CANADA—A. & M. Accessories Ltd., 19 Melinda Street, Toronto; 1405 Bishop Street, Montreal



For difficult moldings in transparent plastic... *Plexiglas*

• Typical of the difficult molding jobs that PLEXIGLAS performs so capably are the examples shown above. For injection molding of the buoy light housing with its long, relatively thin walls, a material with exceptional flow was required... Metal Specialties Company found the answer in PLEXIGLAS. The high-frequency coil forms, molded by Shaw Insulator Company, also presented a flow problem, for weld lines might have affected the critical electrical properties of the part... PLEXIGLAS overcame the difficulty completely.

The properties that proved so effective for these two applications make PLEXIGLAS adaptable to a

wide variety of difficult molding jobs. In fact, our customers have told us time and again that with PLEXIGLAS it is possible to mold parts that *could not be done* in other transparent plastics. Even for simple parts, the excellent molding characteristics of PLEXIGLAS are important, offering the possibility of shorter cycles, fewer rejects, more economical runs.

Now that PLEXIGLAS molding powders are becoming more readily available, it will pay you to take advantage of these superior molding properties for new parts or products. Write today for our latest standard and heat-resistant formulations.

ONLY ROHM & HAAS MAKES *Plexiglas* CRYSTAL-CLEAR ACRYLIC SHEETS
AND MOLDING POWDERS

PLEXIGLAS is the trade-mark, Reg. U. S. Pat. Off., for the acrylic resin thermoplastic sheets and molding powders manufactured by Rohm & Haas Company.
Represented by Cia. Rohm y Haas, S. R. L., Carlos Pellegrini 331, Buenos Aires, Argentina, and agents in principal South American cities.

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

Manufacturers of Chemicals including Plastics... Synthetic Insecticides... Fungicides... Enzymes... Chemicals for the Leather, Textile and other industries



"Who let him in?"



This oversized oarsman doesn't belong in the picture. Strong enough, yes—but much too heavy.

Many materials are like that too; they can't offer KYS-ITE's unusual combination of strength and lightness . . . plus these other "perfect-for-postwar" features found in no other type of material.

GREAT STRENGTH WITH LIGHT WEIGHT—Preformed before curing, an even distribution of phenolic resin on interlocking fibres results in great tensile and compressive strength and with an impact strength up to 5 times that of ordinary plastics.

WIDE RANGE OF SHAPES—Complicated pieces with projections and depressions, large or small shapes and sections—all these and more, too, are molded successfully in KYS-ITE.

KYS-ITE CAN "TAKE IT"—Unusually durable and resistant to abrasion, impervious to mild alkali and acid solutions.

INTEGRAL COLOR—KYS-ITE's lustrous finish is highly durable; the color is an integral part of the material itself. A wipe and it's bright!

NON-CONDUCTOR—KYS-ITE's dielectric properties make it invaluable where safety is a factor. Also a non-conductor of heat. Non-resonant and non-reverberating.

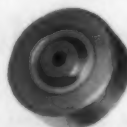
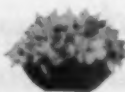
WE WANT TO HELP YOU, BUT—Heavy demand for KYS-ITE is keeping our men and machinery so busy we can't schedule further orders at this time. When the lifting of present restrictions helps relieve this situation, you can be sure we'll let you know.

BUY WAR BONDS—AND KEEP THEM

KEYES FIBRE COMPANY
420 Lexington Avenue
New York 17, New York
Plant at Waterville, Maine

KEYES
MOLDED PRODUCTS

KYS-ITE articles indicating the range of items we mold to specifications and deliver complete, ready for use.



Buy War Bonds—And Keep Them

KYS-ITE

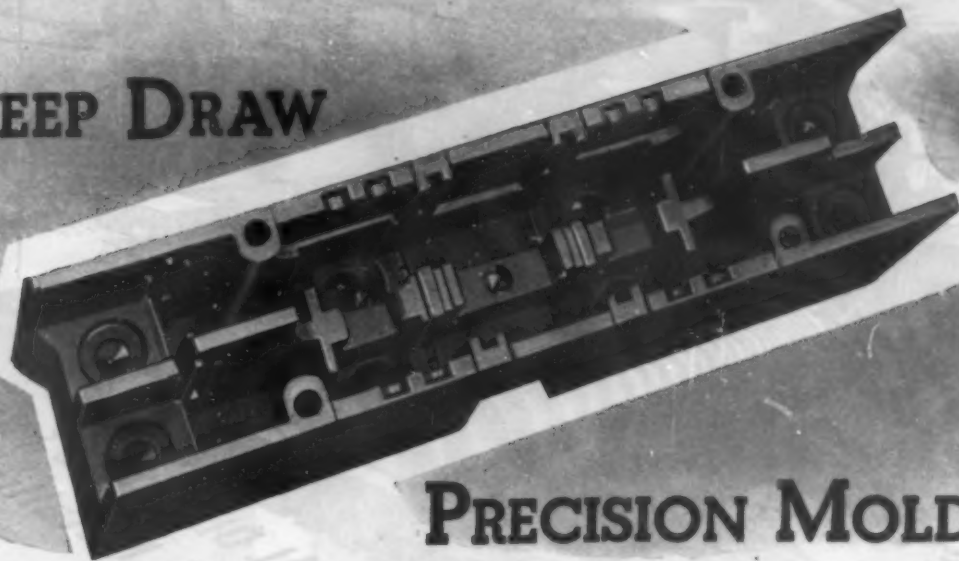
Preformed Plastic Combining Long-

Fibred Wood Pulp and Synthetic Resin

*Trademark Reg. U. S. Pat. Off.

MEGATHERM *Speeds up*

DEEP DRAW



PRECISION MOLDING

Notice the complex interior of this large-size plastic base for a multi-circuit breaker... a finished piece measuring 7" x 2" x 1 $\frac{5}{8}$ "... draw depth 2 $\frac{1}{4}$ ".

To assure dimensional constancy and to accelerate production, twenty preforms of wood-flour-filled bakelite are simultaneously preheated with MEGATHERM... and at one time four finished parts come from the press with a high gloss, almost completely free from flash. Other methods of preform heating previously used on this job brought no success.

This is another typical case showing how MEGATHERM reduces curing time by quick, uniform through-heating of preforms.

High-speed through-heating accelerates the free flow of plastic into all recesses of the mold and permits reduced molding pressure.

Reduced pressure minimizes wear on mold surfaces... and accordingly helps to hold close tolerances in all dimensions of the part.

Use of MEGATHERM thus speeds up the output of high standard plastic products and helps to increase life of molds as well as to reduce rejects and unit costs.

Save time, labor, money and molds... avail yourself of the great improvements in quality and quantity of output that MEGATHERM can bring to you.

See this compact, portable 1 KW MEGATHERM

... a highly versatile unit
... ideal for incorporation into molding presses or into special production set-ups. A foot-pedal switch opens the oven door, leaving operator's hands free to insert the work. Flexible output circuit permits processing a wide range of load weights, heights and materials. Write for complete details now.



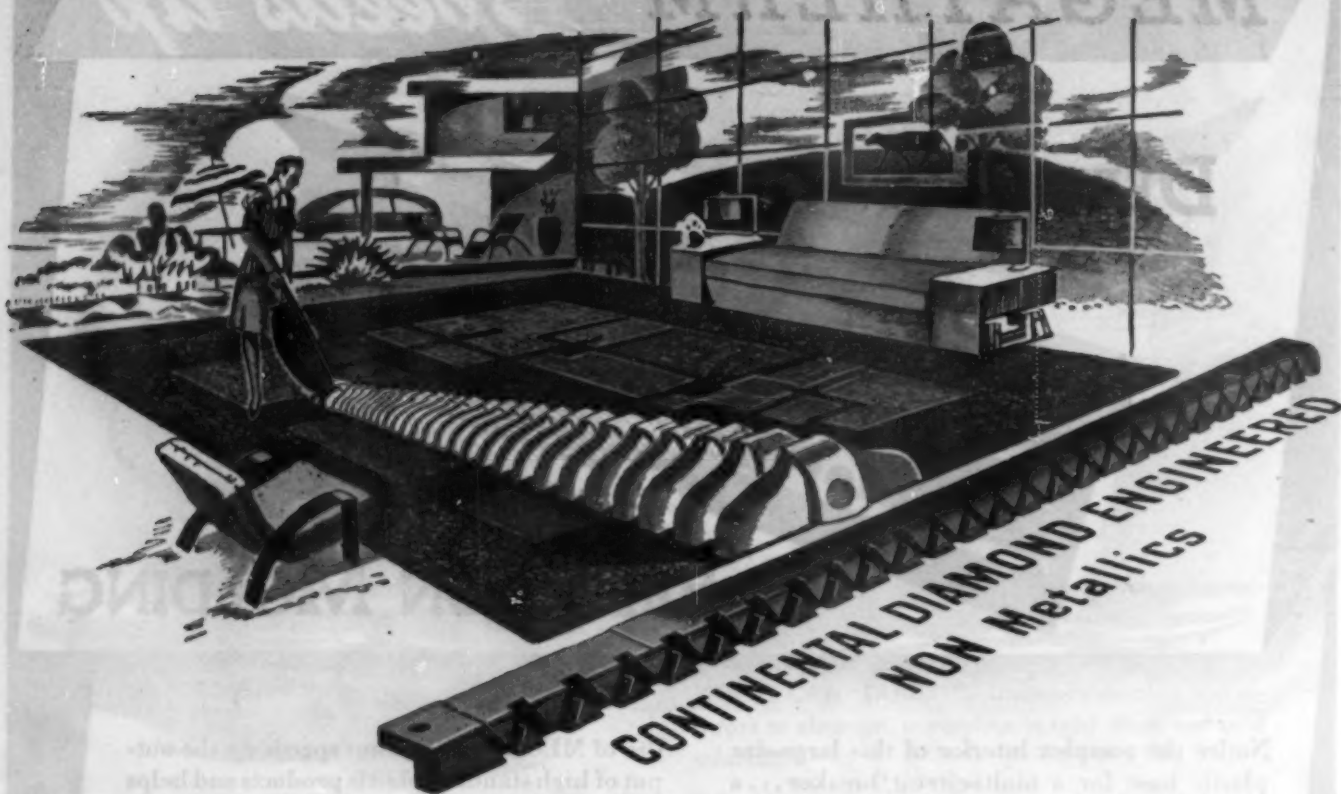
Federal Telephone and Radio Corporation

• Reg. U. S. Pat. Off.



Newark 1, N. J.

UNDER THE MODERN HOUSING



Illustrated above is a C-D DIAMOND Vulcanized FIBRE guide bar used in a Vacuum Cleaner to activate the beating motion of the brush . . . a tough, resilient, light weight material, which could be accurately machined was specified.

KT-45

UNDER modern housings are many C-D products giving unfailing service where the going is tough. Light in weight, tough, strong, resilient . . . with high electrical insulating properties . . . C-D products find many applications in modern appliances and equipment. They may be the answer to your "What Material?" problem.

C-D PRODUCTS

The Plastics

DILECTO—A Laminated Phenolic.
CELORON—A Molded Phenolic.
DILECTENE—A Pure Resin Plastic Especially Suited to U-H-F Insulation.
HAVEG—Plastic Chemical Equipment, Pipe, Valves and Fittings.

The NON-Metallics

DIAMOND Vulcanized FIBRE
VULCOID—Resin Impregnated Vulcanized Fibre.

MICABOND—Built-Up Mica Electrical Insulation.

Standard and Special Forms Available in Standard Sheets, Rods and Tubes; and Parts Fabricated, Formed or Molded to Specifications.

Descriptive Literature

Bulletin GF gives Comprehensive Data on all C-D Products. Individual Catalogs are also Available.

DISTRICT OFFICES

NEW YORK 17 • CLEVELAND 14 • CHICAGO 11
SPARTANBURG, S. C. • SALES OFFICES IN PRINCIPAL CITIES

WEST COAST REPRESENTATIVES
MARWOOD LTD., SAN FRANCISCO 3

IN CANADA:

DIAMOND STATE FIBRE CO. OF CANADA, LTD., TORONTO 8

Continental - Diamond FIBRE COMPANY

Established 1895. Manufacturers of Laminated Plastics since 1911—NEWARK 28 • DELAWARE



Model 18X0

it's easy

This business of "converting" your molding plant to high frequency heat—there's nothing complex about it when you do it with those RED HEAD Thermex units which have been designed for the existing conditions in present day plants. In most cases you simply roll 'em into your present press line. They're simple to operate, too. Anyone capable of opening and closing a drawer can

do a perfect job with any Red Head model. Find out about the complete line of Thermex Red Heads—the most complete line in the field. They range all the way from units that will raise the temperature of one-third pound of average material uniformly 170 degrees in one minute to units that take care of seven pounds in the same time... same temperature rise.

Thermex RED HEADS BY GIRDLER

THE FIRST INDUSTRIAL HIGH FREQUENCY
DIELECTRIC HEATING EQUIPMENT

The Girdler Corporation
THERMEX DIVISION, DEPT. MP-9
Louisville 1, Kentucky

Please send information about the complete line of Thermex Red Heads.

Firm.....

Address.....

Name.....



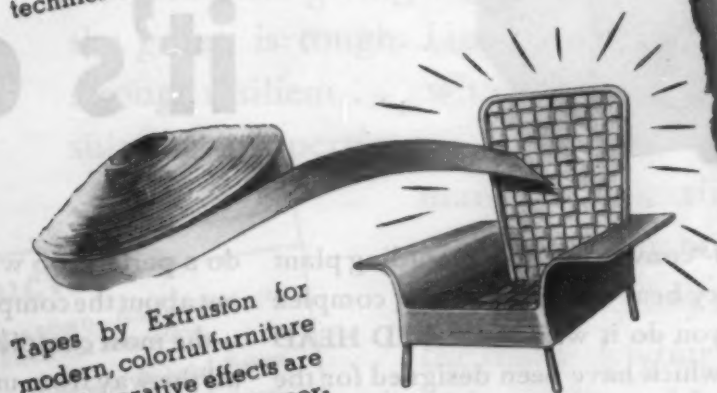
Custom Moulding

OF ALL THERMOPLASTICS

by EXTRUSION and INJECTION

EXTRUDED RODS, TUBES, TAPES and Architectural or Industrial Forms "made by the mile" in continuous lengths, flexible or rigid, in whatever dimensions or colors desired.

Injection molded forms, up to 9 oz. size, simple or intricate, produced to specifications. Ample facilities for volume production. Expert technicians are at your service.



Tapes by Extrusion for modern, colorful furniture and decorative effects are only ONE of the important materials we supply.

"Pioneers in Plastics since 1919"



CELLUPLASTIC CORPORATION

PLASTIC CONTAINERS
AND
PLASTIC PRODUCTS

44 AVENUE L

NEWARK 5, N. J.

NEW YORK OFFICE—670 FIFTH AVENUE

WEST COAST CONTAINER SERVICE COMPANY LOS ANGELES 27, CAL

A message TO USERS OF HARD RUBBER, SOFT RUBBER and MOLDED PLASTICS...

Vulcanized Rubber and Plastics Company

MANUFACTURERS OF RUBBER AND HOLDERS OF PLASTICS
Formerly The Vulcanized Rubber Company

AJAX QUALITY

GENERAL OFFICES
261 FIFTH AVENUE - NEW YORK 16

WORKS: MORRISVILLE, PENNA.

July 18, 1945.

Gentlemen:

Our Plastic Division is now expanded to the point where we can offer research, engineering and manufacturing facilities on molded plastic parts and products as well as those of hard and soft rubber. We have, therefore, adopted Vulcanized Rubber and Plastics Company as a name which is more descriptive of those services.

We feel that we now have a complete service to offer volume users of molded products that ranges from selection of the right material to do the job, to rigid product quality control that assures the user of uniform adherence to specifications.

We have a wealth of experience in fabricating molded items. Starting in 1882 with hard rubber, one of the first plastics, we have constantly sought to convert any new development in plastics to the mutual benefit of our customers and ourselves.

Just as it made sense for us, with our molding experience, to go into the new plastics, it also made sense to continue our fabricating and research on the older plastics ... hard and soft rubber. In many applications they work far better than any of the newer plastics, particularly where resistance to moisture, solvents, oil and heat are the main requirements.

We have the chemical and physical research and testing laboratories and staff necessary to find material to meet the specifications for the job your molded part or product has to do.

Just tell us where and how your part or product has to go to work, or give us the specifications. If we should find that the part or product doesn't belong, economically or physically, in any one of the wide range of plastic, hard rubber, soft rubber, or molding methods that we are set up to handle, we will frankly say so and recommend what we think is best.

Sincerely yours,

Stanley H. Renton
STANLEY H. RENTON,
President.

ENGINEERING MATERIALS TO MEET DESIGNER'S SPECIFICATIONS



Battery case molded
by Gemloid Corporation

When planning conversion to plastics from other materials, the Chemaco laboratory will work with designers to engineer a material and formula to meet the most exacting specifications.

With four basic thermoplastics to work with—Chemaco Cellulose Acetate, Ethyl Cellulose, Polystyrene and Vinyl Compounds—the laboratory has a wide range of basic

properties to build on.

For the battery case, Chemaco Polystyrene was chosen because it is impervious to the acids used in batteries, it is transparent, dielectrically strong and is dimensionally stable. Consult Chemaco engineers for the exact formula in the right material to meet rigid specifications.

Chemaco Corporation

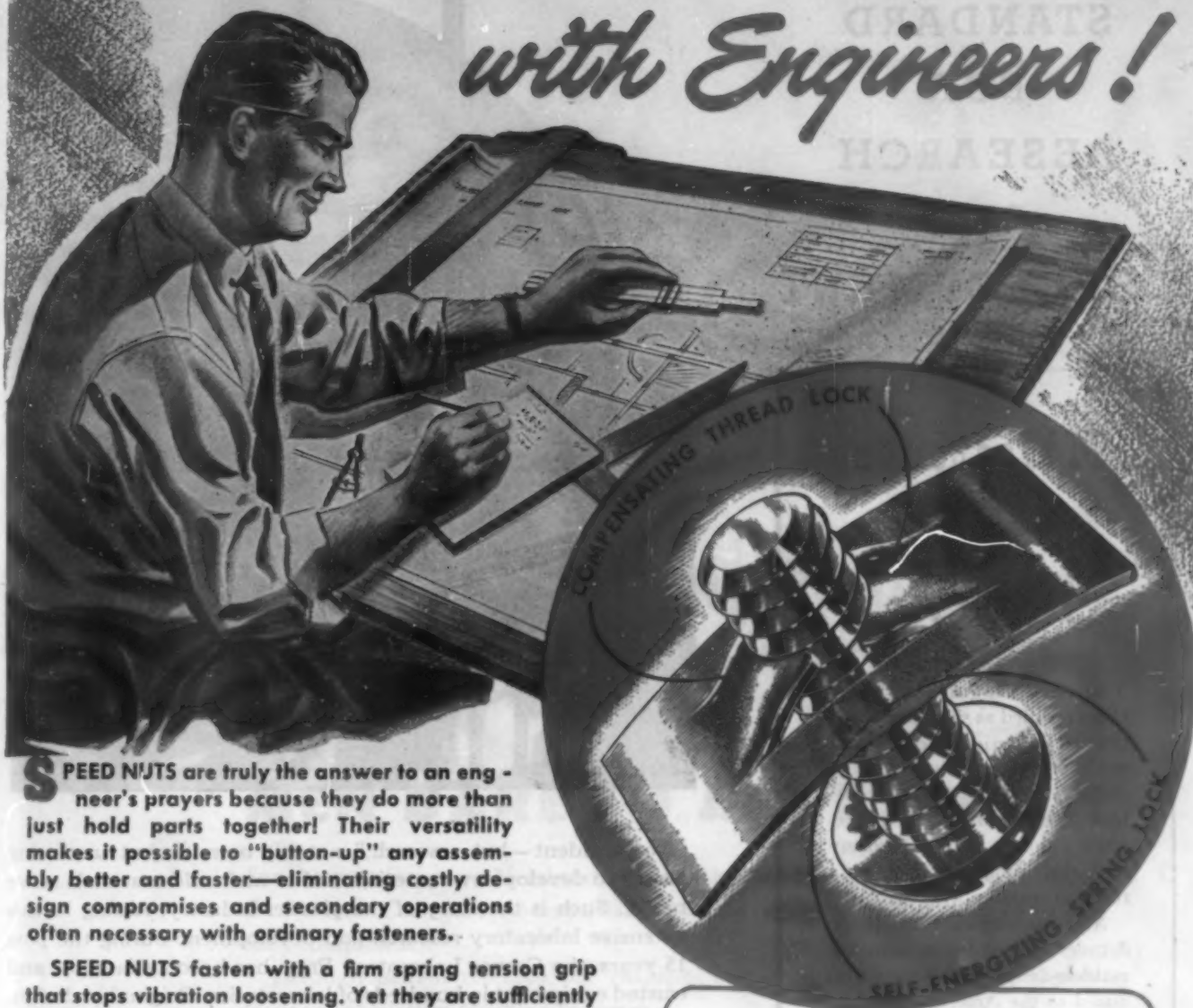
a subsidiary of Manufacturers Chemical Corporation

Berkeley Heights, N. J.

BRANCH OFFICE, CLEVELAND, O.

WHY SPEED NUTS ARE FIRST

with Engineers!



SPEED NUTS are truly the answer to an engineer's prayers because they do more than just hold parts together! Their versatility makes it possible to "button-up" any assembly better and faster—eliminating costly design compromises and secondary operations often necessary with ordinary fasteners.

SPEED NUTS fasten with a firm spring tension grip that stops vibration loosening. Yet they are sufficiently resilient to prevent damage to porcelain, plastic or glass. Some SPEED NUTS are self-retaining, thus eliminating expensive welding, riveting or clinching. They compensate for a wider range of commercial tolerances or misalignment. Having no threads, they cannot "freeze" to bolts or screws... a mighty important point in servicing or repairing your product.

Chances are, you'll be able to find the RIGHT fasteners among more than 3000 shapes and sizes in the SPEED NUT line. If not, we can come up with new ones specially designed for your particular needs. In either case, SPEED NUTS will improve your post-war products and reduce your net assembly costs. Send in your fastening specifications for analysis... TODAY!

NOTHING LOCKS LIKE A SPEED NUT

Only SPEED NUTS provide a COMPENSATING thread lock and a SELF-ENERGIZING spring lock. As the screw is tightened the two arched prongs move inward to lock against the root of the screw thread. These free-acting prongs COMPENSATE for tolerance variations. Compression of the arch in prongs and base creates a SELF-ENERGIZING spring lock. These two forces combine to definitely prevent vibration loosening.

TINNERMAN PRODUCTS, INC., 2048 Fulton Road, Cleveland 13, Ohio

In Canada: Wallace Barnes Co., Ltd., Hamilton, Ontario

In England: Simmonds Aerocastories, Ltd., London

Speed Nuts

PATENTED

Trade Mark Reg. U.S. Pat. Off.

FASTEST THING IN FASTENING... OVER 1000 EXAMPLES AND MORE

THE CARVER LABORATORY PRESS

STANDARD FOR RESEARCH AND DEVELOPMENT

Milestones in Plastics

The mellowing decade sometimes recalled as the "Gay Nineties" was a period of exhaustive work for the men who were conducting research on formaldehyde. Their persistence was rewarded finally by the discovery that the compound formed a resinous product with urea.

Although more than three decades elapsed before urea-formaldehyde plastics were introduced to the American market, these materials quickly formed one of the most important branches of the plastics family tree.

The many desirable properties of this versatile plastic are a tribute to purposeful research, development and improvement, directed at filling specific needs.

Carver Press accessories include electric and steam hot plates and test cylinders or molds. Standard interchangeable accessories are available for general research—cage equipment, bearing plates, filtering equipment, etc. Send now for latest catalog.

PROMPT DELIVERIES FROM
STOCK.



"Not accident—but research," not hit or miss, but unceasing search to develop new materials and to make old materials serve better. Such is the story of the plastics industry. Aiding in this extensive laboratory research and development during the past 15 years, the Carver Laboratory Press has become familiar and trusted equipment in hundreds of laboratories. Original in design, versatile in service, it is standard

- for making quick and accurate small-scale pressing tests.
- for development, research and instruction work.
- for testing single cavity molds.
- for preparation of samples.
- and even for small-scale production.

The Carver Laboratory Press is small, compact,

- has a pressing capacity of 20,000 lbs.
- weighs only 125 lbs.
- operates under self-contained hydraulic unit, giving any precise variations in pressure that may be desired.
- large accurate gauge of finest construction is rigidly mounted on base.
- special gauges are available for low pressure work.

**FRED S. CARVER
HYDRAULIC EQUIPMENT
343 HUDSON ST., NEW YORK 14**



AT
NORTHWEST
Plastics

MEN DARE TO ADVENTURE!

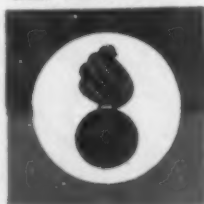
For the past five years Northwest Plastics has made a marked contribution to the National Emergency. Many difficult jobs have been undertaken and successfully completed.

Through patient research our chemists and engineers have developed new trails in the Plastics Molding Industry.

Today, Northwest Plastics offers this outstanding service to companies interested in the finest of plastic molding methods. Write our Engineering Department today for detailed information.

Northwest Plastics, Inc., 2233 University Avenue, St. Paul 4, Minnesota.

ARMY ORDNANCE AWARD



FOR MERITORIOUS
PRODUCTION

*Compression molding • Transfer molding • Injection molding • Extrusion molding
Modern Tool and Die Department • Finishing, Fabricating and Assembling Department
Laboratory for Development and Production Control • Engineering and Product Design*



NORTHWEST PLASTICS inc.

NORTON ABRASIVES



Wetting to keep things **DRY!**

SOUNDS CONTRADICTIONARY, doesn't it? But when you machine methyl methacrylate with a waterproof Behr-Manning Speed-wet Durite belt with plenty of water running over its surface, the seeming contradiction becomes clear.

The picture above was taken in a shop making desiccators for keeping delicate radio, surgical and mechanical equipment bone dry in the South Pacific.

One of the basic operations in preparing containers for the dehydrant, silica gel, is

surfacing the ends of the methyl methacrylate boxes preparatory to adding the end pieces.

Water flowing over the surface of the waterproof abrasive belt keeps the plastic cool and leaves a clean, sharp, accurate surface for sealing the gel until its action is released for duty on the battle fronts. Dry sanding would produce a powdery, clinging residue, but sharp Behr-Manning belts with plenty of water cut for hours and help turn out hundreds of perfect boxes.

SPECIALIZED Abrasive Engineering Service is available free. Just drop a line on your letterhead or, quicker yet, phone our nearest branch.



Boston, Buffalo, Chicago, Cincinnati, Cleveland, Detroit, Grand Rapids, High Point, Indianapolis, Los Angeles, New York, Philadelphia, St. Louis, San Francisco, Tacoma



BEHR-MANNING • TROY, N. Y.

(DIVISION OF NORTON COMPANY)

Quality Coated Abrasives Since 1872

DU PONT FORMALDEHYDE

HIGH PURITY • UNIFORM STRENGTH
WATER-WHITE COLOR • LOW ACIDITY

DU PONT FORMALDEHYDE is produced under rigid control and supervision. The product is designed to meet the high requirements of the plastics industry.

SHIPMENTS in standard containers are made from the factory or stocks maintained in principal cities.

AVAILABILITY subject to WPB General Allocation Order M-300 Appendix A Materials. Under Schedules 9 and 10, "Small Order Exemptions," 1,500 lbs. of 37% Formaldehyde, 500 lbs. of Paraformaldehyde and 10,000 lbs. of Hexamethylenetetramine can be obtained without application to WPB. Quantities in excess of the above require application on form WPB-2945 (PD600). Filing date is 15th of month preceding month of delivery. Depend on Du Pont also for: **PARAFORMALDEHYDE**—powder or granular 95% minimum strength. And **HEXAMETHYLENETETRAMINE**—U. S. P. crystals or technical. Call our nearest district office for information and technical assistance. Electrochemicals Department, E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Delaware.

District Offices: Baltimore, Boston, Charlotte, Chicago, Cleveland, Kansas City, * New York, Philadelphia, San Francisco. *Baruda & Page, Inc.

SAVE PAPER—IT PACKS A WAR PUNCH



**BETTER THINGS FOR BETTER LIVING
... THROUGH CHEMISTRY**

DU PONT ELECTROCHEMICALS



Set viewed under regular lighting



The same set under "black" light

LUMINESCENT RADIO DIALS and decoration will add extra sales value to the postwar radio, particularly to television sets. (The dials and the model's dress are fluorescent, and the knob-insets and the flower in the model's hair are phosphorescent.) Cabinet front is so designed that back lighting by "black" light installed within the set may be employed.

Designing with Luminescent Plastics

RECENT developments in rigid plastic sheeting, injection molding and laminations pigmented with **HORSE HEAD* Luminescent Pigments** now offer the designer considerable flexibility in his approach to the designing of luminescent products or parts. Both **HORSE HEAD* Fluorescent Pigments** and **HORSE HEAD* Phosphorescent Pigments** have been incorporated in plastic sheets—cast, block pressed and calendered—and producers are prepared to consider inquiries from fabricators and designers. Likewise, molding compounds, carrying **HORSE HEAD* Luminescent Pigments** in acrylic resins, polystyrene, cellulose acetate and urea-formaldehyde resins, have been prepared and the producers are ready to consider inquiries.

Our technical staff will be glad to cooperate with you on applications where **HORSE HEAD* Luminescent Pigments** are indicated.

*Registered, U. S. Patent Office.



MANY and VARIED APPLICATIONS for HORSE HEAD LUMINESCENT PIGMENTS

FLUORESCENT:

Architectural trim
Automotive and aviation dials and accessories
Decorative effects
Displays and advertising
Display fixtures
Light diffusers
Radio dials and decoration
Theatrical effects

PHOSPHORESCENT:

Apparel accessories
Ash trays
Automotive accessories
Cord pulls (lights and window shades)
Costume jewelry
Decorative effects
Door knobs and kick plates
Electric switch plates, fixtures and equipment
Escutcheons and medallions

Flashlights
Fish lures
Games and toys
Household items
"Juke" boxes
Marking tapes
Product packages and labels
Push buttons
Telephone handsets
Tools



HORSE HEAD PRODUCTS
New Jersey
Zinc

THE NEW JERSEY ZINC COMPANY

160 FRONT STREET • NEW YORK 7, N. Y.

Products Distributed by THE NEW JERSEY ZINC SALES COMPANY
NEW YORK • CHICAGO • CLEVELAND • SAN FRANCISCO

Who sets the *Quality Standard*



QST #1 Filament and Grid support wire is "miked" and weighed to meet specifications since slightest variations affect tube characteristics and performance.



QST #2 Quantitative analysis of Filament Sprays and Chemical Getters is made to insure correct ratios of the active ingredients.



QST #3 Although triple-distilled the Mercury used in United tube is further processed to prevent contamination by minute traces of impurities.

FOR TRANSMITTING TUBES

STEP-BY-STEP, from raw material to final product, nothing is taken for granted at United. For instance, all raw materials that enter into the evolution of a United tube are checked and tested with searching chemical and metallurgical care in our own laboratory pictured above. These tests complement our regular inspections for exacting mechanical standards.

Such vigilant Quality Standard Tests of raw materials are essential to assure the sterling qualities of United Tubes. For the name United carries a great responsibility with engineers everywhere. It is a *trusted standard* for comparing transmitting tubes which must be zealously guarded and always maintained.

But the final test rests with you, so let United tubes prove themselves by actual performance. Try them when you make your next replacements. Write for a copy of our latest catalog. Order direct or from your Electronic Parts Jobber.

*Quality Standard Test

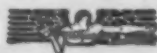
Masterpiece of

Skilled Hands

UNITED

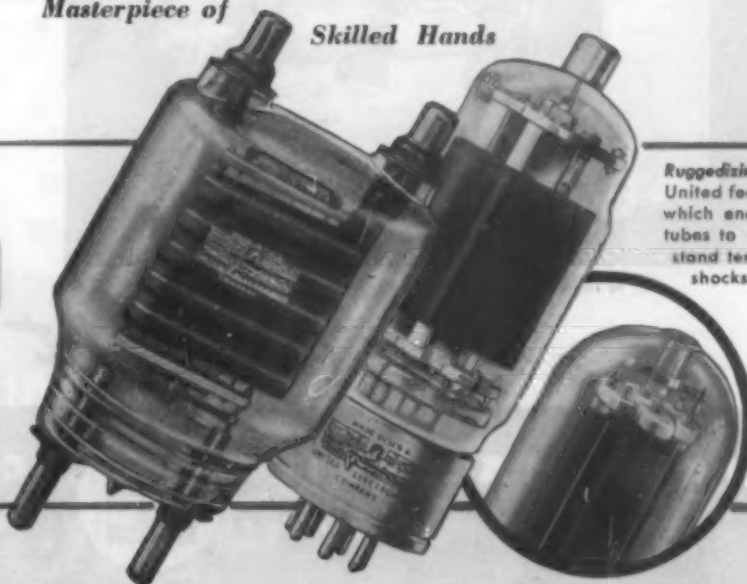
ELECTRONICS COMPANY

NEWARK, 2

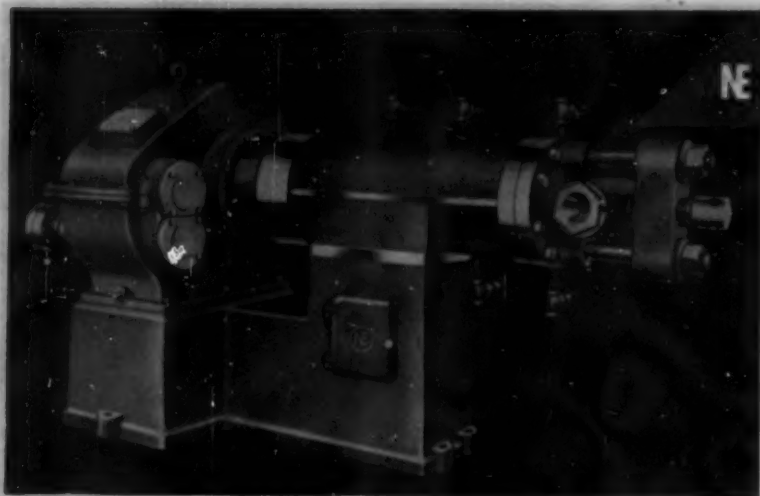


NEW JERSEY

Transmitting Tubes **EXCLUSIVELY** Since 1934



Ruggedizing: A United feature which enables tubes to withstand terrific shocks.



3 1/2" NE Single Stage Extruder with two zones of heating

NE Single STAGE EXTRUDERS

are widely used where materials are readily plasticized. Illustrated is a 3 1/2" Resin Extruder with special cylinder construction and two zones of controlled heating.



3 1/2" NE Dual Stage Extruder features two stages of plasticizing and four heat control zones

NE Dual STAGE EXTRUDERS

were developed to meet special material characteristics. National Erie, as a pioneer builder of extrusion equipment for rubber products, has developed special extrusion machines for plastics users. The dual extruder illustrated is a very recent development.



4 1/2" NE Triple Stage Extruder with five heat control zones

NE Triple STAGE EXTRUDERS

represent the very latest thought and design and are being developed to meet the most severe conditions of plasticizing. The triple stage extruder shown is used on vital war work and features a compact independent drive on each stage and progressive controlled heating.

Write for Booklet



NATIONAL ERIE

Erie, Pa.



CORPORATION

U.S.A.

11 REASONS WHY YOU SHOULD BUY THE RCA 2B ELECTRONIC PREHEATER

SCIENTIFICALLY DESIGNED ELECTRODES—Even and efficient heating is ensured by scientific electrode design—rounded edges—heat-reflective surfaces.

SELF-LEVELING UPPER ELECTRODE—Ball-type joint with spring tension, automatically adjusts to any size preform; ensures good fit; keeps efficiency high.

AUTOMATIC TUNING FOR MAXIMUM OUTPUT—Another RCA first—automatic electronic control adjusts heating rate to preselected level and keeps it there. Adjusts for changes in material, as it heats, and for variations in preform dimensions and material. Enables preheating up to 50% more material.

FRONT AND BACK DOORS FOR EASY ACCESS—For convenience in inspection and maintenance, front and back doors provide easy access to all working parts. Tumbler locks prevent unauthorized tampering.

COMPACTNESS; CONVENIENCE—Floor space required is only 30 by 25 inches. Right height plus handy controls and automatic features make operating convenient. Easy to move from press to press.

TOP OPENING AT WORKING LEVEL—Top opening unit for operator convenience—an RCA first; no stooping for loading or unloading. Screen construction of safety cage provides good view of work and adequate ventilation.

AUTOMATIC OPENING AFTER HEATING—No wasted time when operators use the RCA Model 2B! Top opens, power goes off, upper electrode lifts—all automatically—when timer trips. Just reach in for uniformly plasticized preform.

AUXILIARY SURFACE HEATING—To prevent preform surface cooling and moisture condensation on electrodes, two infra-red lamps supply auxiliary surface heating. Lamps also provide light on work.

SAFETY INTERLOCKS ON CAGE AND DOORS—Complete safety for operators and maintenance men is provided by electrical safety switches, which shut off high-voltage circuits and ground them whenever cage or access doors are opened.

AUTOMATIC OVERLOAD PROTECTION—In case of accidental overload of the generator, RCA fast-acting overload protection guards tubes and generator components.

FORCED-DRAFT COOLING; FILTERED AIR—Efficient blower cools tubes and components with air drawn through spun-glass filter.



ORDER NOW FOR QUICK DELIVERY!

You can obtain quick delivery of RCA electronic preheating equipment if you order at once. Write: Radio Corporation of America, Electronic Apparatus Section, Box 70-19; P, Camden, N. J.

RCA
ELECTRONIC
HEAT



BUY
WAR
BONDS

RADIO CORPORATION
OF AMERICA

RCA VICTOR DIVISION • CAMDEN, N. J.

Mail This Today for FREE Booklets

RCA, Electronic Apparatus Section, Box 70-197P, Camden, N. J.
Please mail to me, without obligation, the following booklets on economical, high-speed electronic heat, which increases press output 50% or more.

RCA MODEL 2B HEATER—The 2000-Watt Automatic Unit with Automatic Compensation for Increased Heating Capacity.

RCA MODEL 15B HEATER—The 15,000-Watt Unit for Preheating Large Quantities of Molding Material.

BOOKLETS ON PREHEATING PLASTICS with high-speed electronic heat.

Name _____
Position _____
Company _____
Address _____ Zone _____ State _____
City _____

70-4320-197

UNERRING hands

need this *Floating* lamp

Precision engineering and manufacture call for unerring hands. But hands, unfortunately, can do well only what the eyes see clearly.

Aided by the *flexible, intense localized* lighting provided by Dazor *Floating* Lamps—instantly adaptable to the needs of each worker, each job—your employees will see the fine details of work easily, comfortably, accurately. Their hands will work faster with fewer mistakes and minimum fatigue.

And a touch of the hand does it—*floats* the Dazor Lamp to any desired position, where, without adjustment or locking, it *stays put* until moved to a new position. This exclusive feature results from a patented enclosed balancing mechanism.

Near you is a Dazor-appointed distributor who is qualified to give sound, practical advice and application assistance. Phone him for detailed information and a demonstration of the Dazor *Floating* Lamp under actual working conditions. His name, if unknown to you, can be secured by writing to the Dazor Manufacturing Co., 4483 Duncan Ave., St. Louis 10, Mo. In Canada address all inquiries to the Amalgamated Electric Corporation Limited, Toronto 6, Ontario.

PHONE THE DAZOR-APPOINTED
DISTRIBUTOR NEAR YOU TODAY

DAZOR *Floating* LAMPS

FLUORESCENT and INCANDESCENT



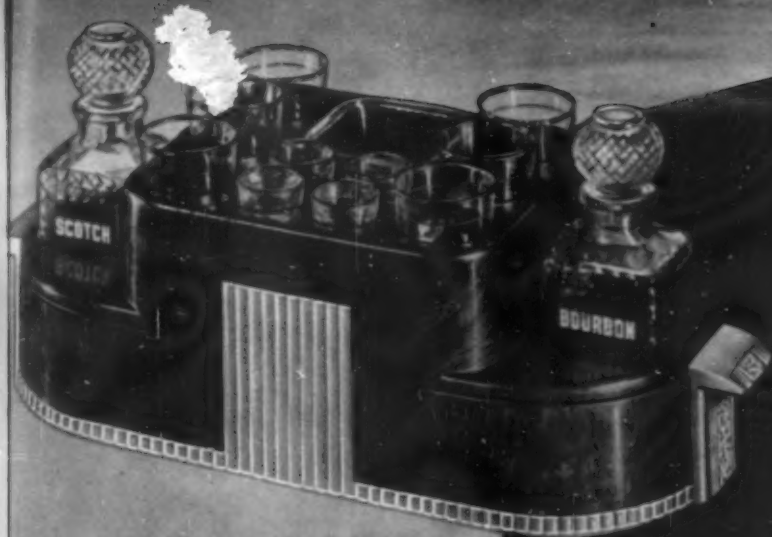
MOVES FREELY INTO ANY POSITION



STAYS PUT WITHOUT LOCKING

CHOICE OF 4 BASES





PLASTIC PERFECTION

IS COMPOUNDED OF MATERIALS, METHODS
... AND INVENTIVE ENGINEERING SKILL

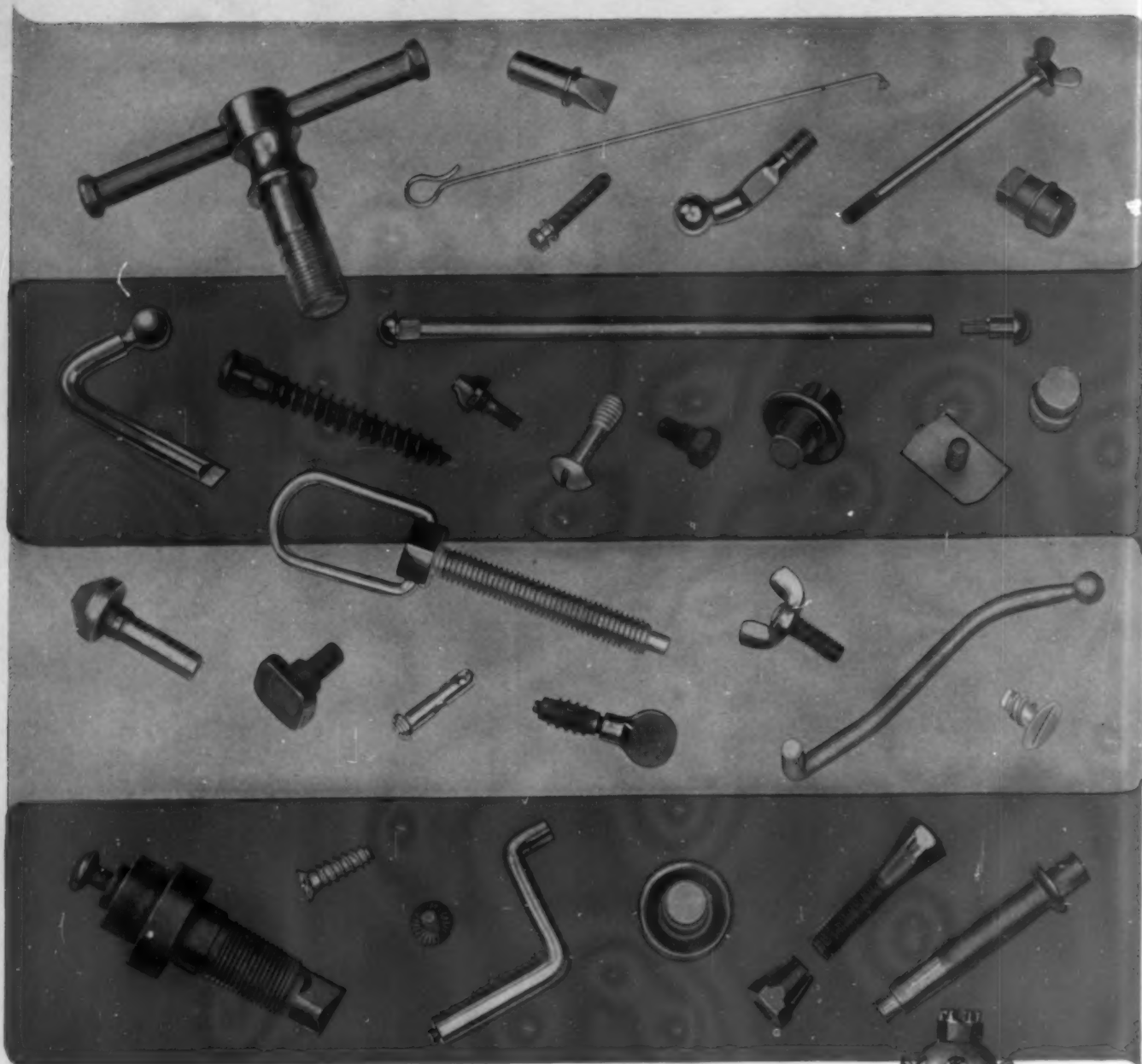
Consider these examples from the presses of MOLDED PRODUCTS. Each in its own way represents the best solution to the plastic molder's problem: "How can the remarkable properties of plastics best be utilized for this particular job?"

★ Thus plastic housings should combine structural strength with beauty of color, contour, and "feel." In functional members, high strength-to-weight ratio is usually of paramount importance. Often, as in the case of the washing machine agitator, equal emphasis is placed on additional properties . . . like low moisture absorption, resistance to hot water and soap and the absence of corrosive effect. Plastic casters are molded from naturally resilient materials to withstand shock. Small components for electric or electronic devices can be molded to critical electrical standards.

★ Yes, plastics can achieve near-miracles for industry . . . when their use is guided by imaginative engineering skill and production "know-how."

These are the "components" which we, at MOLDED PRODUCTS, offer you. Ask one of our engineers to consult with you, or send us your specifications for quotation. MOLDED PRODUCTS CORPORATION, 4535 W. Harrison St., Chicago 24, Ill.

CASTINGS DIVISION
MOLDED PRODUCTS
CORPORATION



Yes• we make "SPECIALS"!

Just take a good look at the picture above—a sample assortment of nonstandard products which we have made by the upset method. Most of these could not have been produced, in the time and quantity required, in any other way.

The upset or cold forging method also saves materials and lowers costs. And in many cases it makes a stronger, better product than that produced by other methods.

Maybe we can show YOU some important SAVINGS. Tough "specials" are right down our alley. Write us.



National
HEADED AND THREADED
PRODUCTS

THE NATIONAL SCREW & MFG. CO., CLEVELAND 4, O.

MODERN PLASTICS

SEPTEMBER 1945

VOLUME 23

NUMBER 1

Rockets—and their plastic components

by W. WARD JACKSON†

Plastics played an important role in the success of the Army and Navy rockets which became in a few years time one of the most powerful of our weapons

THE vital role that rockets played in modern warfare became a matter of common knowledge a few months ago when the Navy announced that it had expanded its Rocket Program to \$100,000,000 per month, with the Army requirements increased to approximately \$12,000,000 per month. When a single type of ammunition rises from the experimental stages of development to a program which is expected to equal the combined expenditures of all other types of ammunition in the Navy—that's News—and not too pleasant news for the enemies of our country.

Rockets rate among the top priorities in the nation today, necessitated by the urgency for this type of ammunition on all of our war fronts, by the tremendous quantities involved, and by the magnitude of the production problems associated with a program of its size. The plastics industry is indeed privileged to have had a part in the program that will go far in bringing the war to a successful conclusion.¹ Today, plastics are being used for such rocket components as cellulose acetate inhibitor strips rocket assembly units, igniter box closures and rear closures; ethyl cellulose bayonet igniters, igniter boxes, igniter support and spacer disks.

Rockets have grown from the experimental laboratories and

development branches of the Armed Forces to be one of the most spectacular, most powerful and vital weapons of the war. Yet the theory of the rocket has been known for centuries. During the invasion of China by the Mongolian Kublai Kahn in the year 1232, the Chinese used rockets with marked success in the defense of their cities, while between 1250 and 1400, rockets were used intermittently.

In 1788, the Indians used rocket-propelled spears against the British in India and about twenty years later, the British used rocket-equipped ships against the Danish fleet in their attack on Copenhagen. It is also interesting to note that during the War of 1812, the British are credited with achieving a tactical break-through of the American lines during the battle of Bladensburg, Md., when the Royal Rocket Brigadiers routed our troops, resulting in the capture of Washington.

Shortly after that, further attempts to eliminate the need for the rocket stick failed and subsequent improvements on artillery pieces led to the eventual loss of interest in rockets which has continued until just recently.

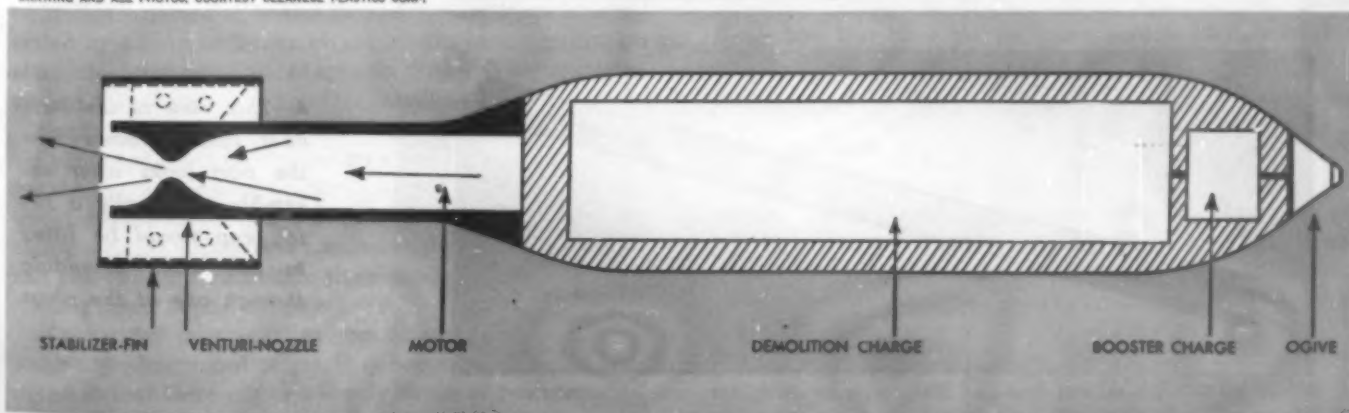
Development of the rocket program

The success of the current program has been due largely to the close cooperation between development maintenances and industry. Research and development of the rockets in

† Director of Product Application Division, Celanese Plastics Corp.
¹ For security reasons no mention is made of the prime or sub-contractors, extruders and molders to whom considerable credit is due.

1—The approximate relationship of the various rocket components is indicated in this rough sketch of one of these death dealers. Among the plastics used in this ammunition are cellulose acetate and ethyl cellulose

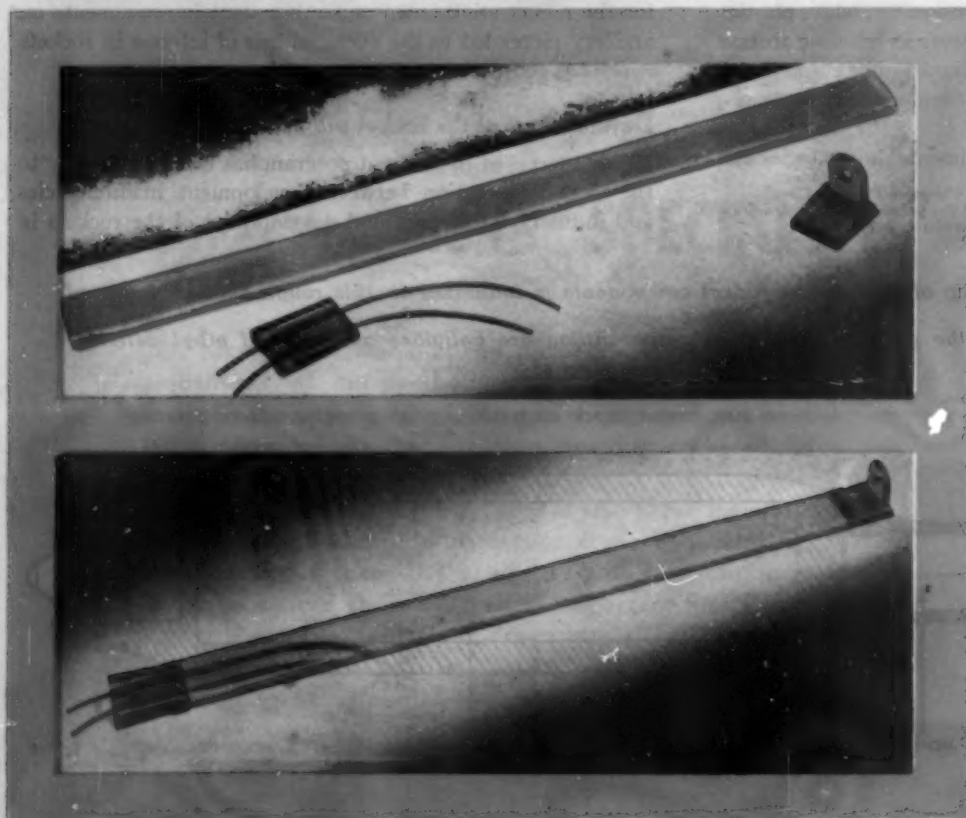
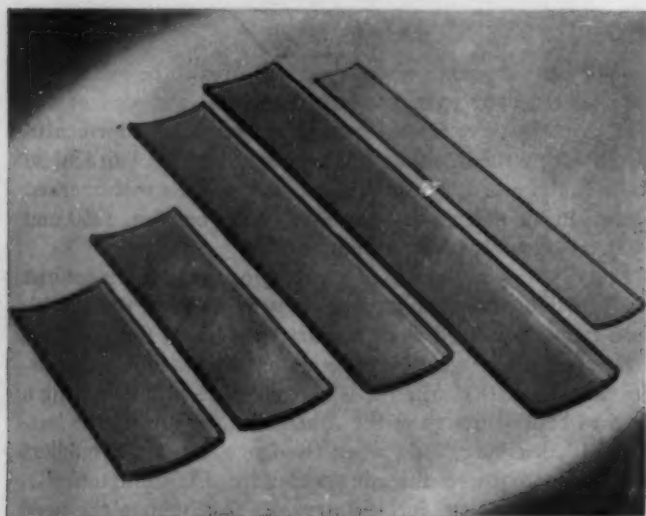
DRAWING AND ALL PHOTOS, COURTESY CELANESE PLASTICS CORP.



the United States have been a joint venture on the part of the Navy Department, the War Department and the Office of Scientific Research and Development on the one hand, and the best technical brains of a dozen major industries—the plastics industry being numbered in this latter group. The various National Defense Research Council groups at California Institute of Technology in Pasadena and the George Washington University have also contributed to this work.

The Navy currently is concentrating on the production of Navy type rockets which are being used by all services, while the Army has been made responsible for the production of the solventless propellant charge for these rockets. However, the Army is producing most of its own rockets. The Navy in turn has been made responsible for the loading and testing of

2—Inhibitor strips extruded of cellulose acetate are produced today in greater quantities than any other plastic part which is used in the Army and Navy rockets



3—The bayonet igniter in the 4.5-in. Army rocket consists of a long strip extruded from ethyl cellulose and two plugs molded of the same material

4—This view of the bayonet igniter shows how the part looks after assembly. Normally a firing cap would be fitted to the wires extending through one of the plugs

various types of rockets. Interdepartment cooperation has greatly increased the over-all efficiency of production operations and has been indispensable in view of the fact that new developments in rocket warfare are almost continuous and the tactical uses are in a state of constant flux.

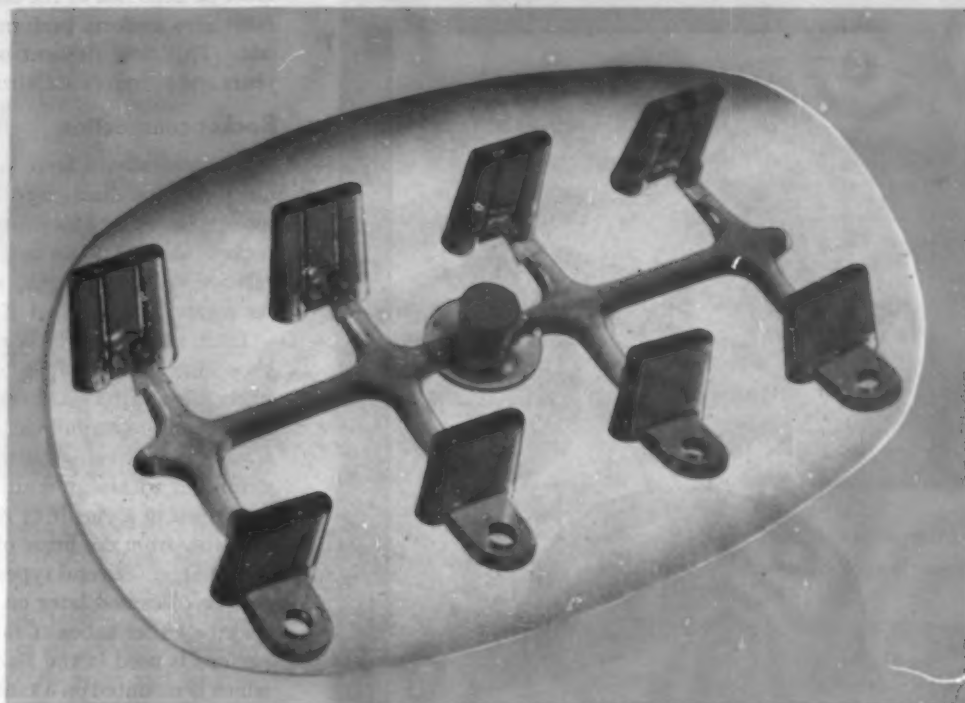
The sudden development of the rocket as one of the most formidable of modern weapons has not been without production headaches. There was little time to build pilot plants, test materials or draw up extensive specifications; in many cases new designs were outmoded before real production could be realized. Plastics manufacturers were called upon to meet hitherto impossible delivery dates, work to almost unheard-of tolerances and yet maintain a constant flow of parts to the loading plants. The material suppliers were required to expend inexhaustible man hours in research on the problems of stable formulations, nitroglycerine absorption, cementing techniques, molding cycles and production difficulties.

Advantages of the rocket as a weapon

Before getting into the details of the rocket theory and specific plastic applications, it would be well to dwell for a moment on some of the advantages of rockets. The main advantage that exists today over our artillery is that rockets, having no recoil, can be fired from small and, in many cases, mobile installations. The absence of recoil permits the use of light, compact and simple constructed rocket launchers that can easily be installed on planes, landing craft, tanks and other light vehicles. There is a tremendous advantage in the production of these light parts which are easily turned out in tremendous quantities by modern mass production methods.

Because rockets are not nearly so accurate as guns in terms of range, pin-point effectiveness and precision, they are usually fired in salvos, thus blanketing a given object. However, from aircraft, rockets can be flown in at a target at high speed and launched with greater accuracy than bombs. The distance at which a rocket can be effectively aimed and launched greatly lessens the danger to the aircraft.

5—One of the molded ethyl cellulose plugs on the bayonet igniter is constructed so that wire can be threaded through it. Four of these plugs and four solid plugs are molded at one time in an 8-cavity die



At the present time there are more than seven main types of rockets, production falling into four main use classes:

1. Rockets against ground installations from launching craft, jeeps or other ground equipment.
2. Air to ground, that is, from aircraft against tanks, pill-boxes and similar objectives.
3. Anti-aircraft ground installations to be fired at aircraft.
4. Rockets for special uses including smoke, barrage, signal, range and locating type.

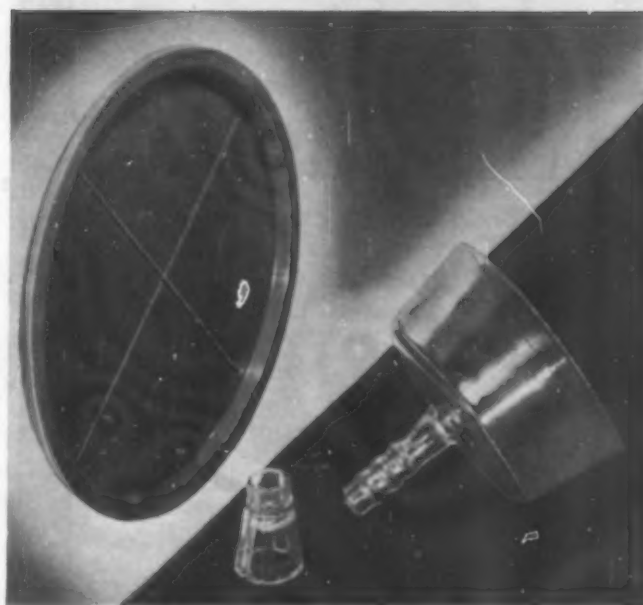
Theory of motivation

In order to best understand the rocket, let us consider for a moment the reasons why a rocket functions. The rocket is a complete gun in itself, consisting of four major parts: 1) the explosive head, containing TNT or other ingredients; 2) the rocket motor, which is nothing more than a tube closed at the head end opening through a venturi type nozzle at the rear end which contains the chemical charges to produce the large quantities of gases needed; 3) the nozzle, tapered to make most efficient use of the accumulated gas pressures; and 4) the stabilizer or fins controlling flight.

When the rocket is fired or ignited there is a rapid burning of gases in the rocket motor, resulting in great equal pressures being exerted on all internal surfaces of the rocket motor tube according to the principles expressed by Newton's Third Law of Motion. According to this Law, any mass which is accelerated by a force within an object, results in the generation of another force, equal and of opposite direction, being applied against that object.

Simply stated, the motion of a rocket can be likened to that old childhood sport of blowing up a toy balloon and releasing the slender air tube quickly. As you recall, the balloon would shoot wildly forward into the air with the burst of escaping air. By supplying a continuous flow of escaping thermal gases and by controlling these gases, you have the motivating power behind the rocket.

If the rocket is expected to travel along a given path and strike a predetermined target, it is important that it be designed so that there will be a steady thrust of predetermined magnitude throughout the propelling period. Therefore,



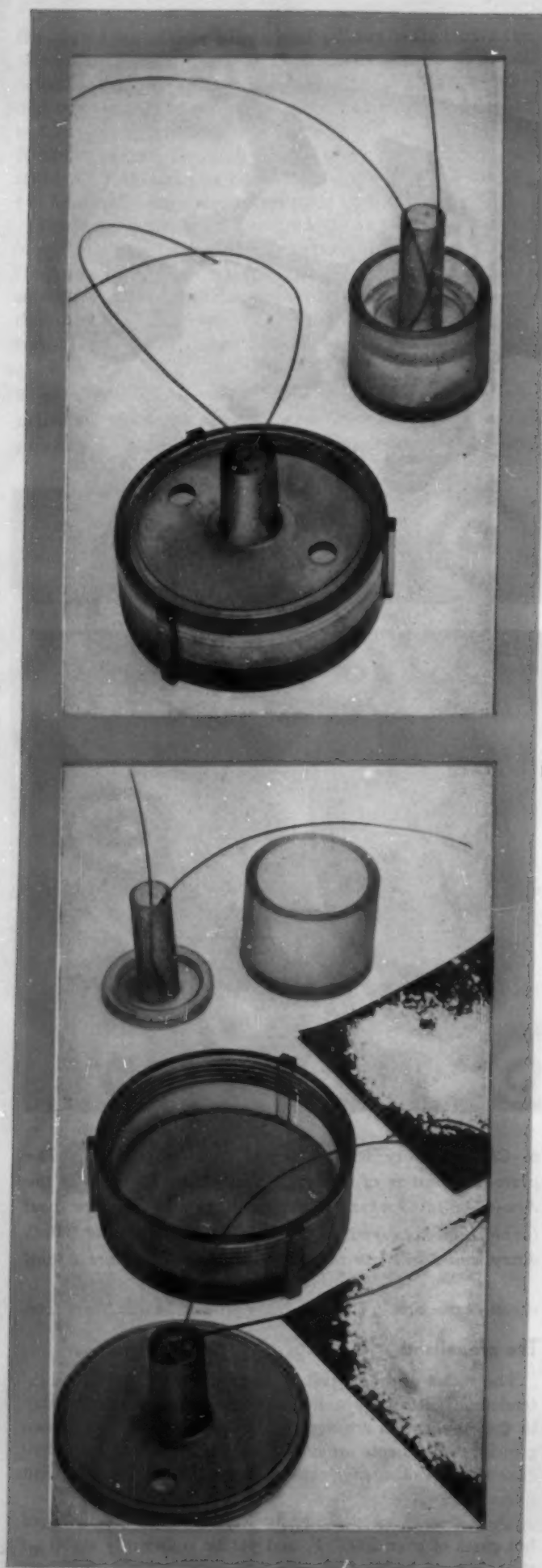
6—Closures vary with different types of rockets. The plate-like part is of cellulose acetate and is used in the Army 4.5-in. rocket. The small ethyl cellulose part (center) is employed in the 2.36-in. Army rocket. Both Army and Navy use the cellulose acetate closure (right)

chemical reaction in the tube must proceed at a uniform rate.

The propellant

The choice of the propellant charge depends on the use intended. Generally speaking, most powder grains used today in this application are designated *double base*, meaning two principal ingredients are used; nitrocellulose, and nitroglycerine or some other high explosive ingredient compatible with nitrocellulose.

These grains are designed to liberate large quantities of hot gases of over 3000° F. and yet be sufficiently stable so that they can be handled under all conditions. Great import



must be attached to the stable nature of the propellant which must give uniform performance even after long storage periods. This time element may be from a few days to several years and therefore stabilizing ingredients are added.

Rocket construction

Mechanically, a large percent of the accuracy obtained is due to the stabilizing medium which may be achieved on some models by using fins located in the nozzle end or rear of the rocket tube. Balance in the rocket itself is important and the relation between length, weight and center of gravity must be carefully controlled if it is to be an effective weapon.

Ignition of rockets is usually controlled electrically, and they may be fired singly or in salvos. This firing is accomplished by battery units charged by generators aboard planes or fed by similar units attached to the landing craft engines. Closing the circuit causes a spark to ignite a small cap-type detonator within an ignition charge of black powder equally contained in a plastic or metal case. The flame and pressure resulting from the firing of the black powder fires the propelling charge. Several types of plastic igniters are used; these will be discussed later on in the article. Launching devices may be either tubes or rails and can consist of a single tube such as is used in the Bazooka or a combination of 60 tubes which is mounted on a tank.

Sizes of rockets

The sizes of the various rockets have increased since the development of the Bazooka in 1942. Actually there is no limit to the size that can be produced and experiments on very large types are probably currently under way. Recent publicity indicates that we actually have in production "buzz" bombs similar to the German V-1.

Current Army rockets include the 2.36, the 3.25, the 4.5 and the 7.2-in. rocket. Of course, each diameter may have several separate designation numbers denoting the type of firing head, rocket charge or other special features.

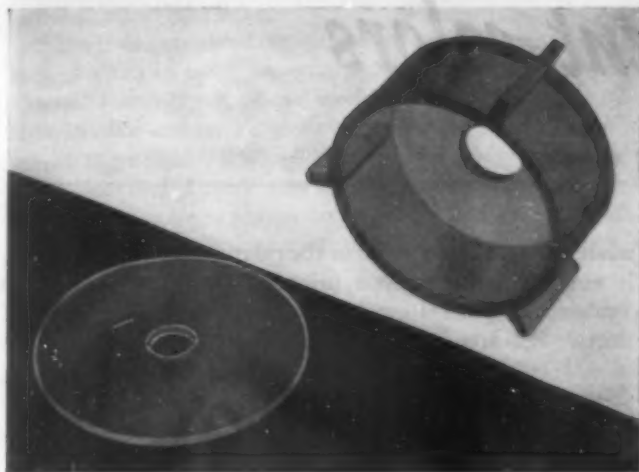
Navy rockets include among others the 2.25, 3.25, 5.0 and 7.2 with the accompanying number of variation. An interesting comparison may be made from the fact that a 4.5-in. Army rocket, equal in explosive effect to the 105 MM artillery piece, weighs about 40 lb. and a single tube launcher 22 pounds. The equivalent artillery piece weighs over 5000 pounds.

Plastic parts in the rocket

Inhibitor strips—The largest production of plastic parts currently used on the rocket program are the plastic inhibitor strips (Fig. 2) now extruded of cellulose acetate. However, other compositions are under study. This strip is actually cemented on to the sides of the solid powder grain to control or inhibit too rapid burning. The most important requirement of these parts is that they cement with a firm bond to the grain and do not loosen, turn up on edges, warp from contact with the powder. Great care must be taken to use a tough, resilient plastic that will age well and yet can be easily extruded to close tolerances.

The selection of the formula was the result of considerable work on the part of the Navy engineers in the Bureau of Ordnance and the material suppliers. Careful tests had to be run to develop a material which would not absorb too much

7 and 8—Transparency is important in these two igniter boxes (shown assembled and disassembled) since it aids in the loading operation. The unit in the background is a 2.36-in. front end Army igniter box; that in the foreground an igniter box for a 2.25-in. Navy rocket



9—This transparent igniter support and spacer disk for one of the Navy rockets are molded from ethyl cellulose

nitroglycerine from the powder grain to change the firing characteristics or to disturb the bond of strip to powder grain.

These strips are extruded into several sizes and lengths. Close tolerances, clarity and flatness are of importance.

Extruded bayonet igniter—In the 4.5-in. Army rocket an ethyl cellulose extruded part together with two molded plugs comprise the igniter. Figure 3 shows the extruded strip, the base plug and front plug—the latter demonstrating how two contact wires might be fitted in; Fig. 4 shows how the part will look when loaded, except for the firing cap which would normally be fitted to the ends of the wires in the top plug.

Contact made electrically fires the powder contained in the tube, exploding it with a shower of burning sparks. Since this tube fits down into the rocket motor and is surrounded by extruded powder rods in the 4.5-in. model, a resultant firing of the igniter sets off the motor charge and the rocket is off.

An important consideration in the selection of ethyl cellulose for these parts was the necessity of getting a material that would burst evenly to achieve uniform firing yet would not clog the nozzle when blown out with the hot gases. Nitroglycerine absorption, extrudability and strength characteristics were also important. Figure 5 shows the top and bottom plugs as they come from the mold.

Igniter boxes—These powder containers are used primarily to hold the preliminary powder charge that sets off the rocket motor powder grains. Here again, ethyl cellulose is being used because of its low nitroglycerine absorption.

Figure 6 shows three typical closures currently in use. The round plate-like part (left) is the Army closure for the 4.5-in. rocket, produced from cellulose acetate. Special stable materials must be used, since these parts are cemented to the metal side walls. Impact strength is also important.

A 2.36-in. Army closure (center, Fig. 6) is made of ethyl cellulose. Wires are channeled through the slots on the sides to the outer connecting system of the firing mechanism.

The molded cellulose acetate part at the right in Fig. 6 is an Army and Navy rocket closure. The outer connecting wires go through the center of this part, are crimped and sealed.

Figures 7 and 8 show two more igniter boxes, both small, as they appear assembled and disassembled. The unit in the background is a 2.36-in. front end Army igniter box, that in the foreground a Navy 2.25-in. igniter box. Transparency is important as an aid to the loading of these containers and, together with the speed of production of the molded parts, has gone far in advancing the rocket program.



10—Ethyl cellulose is used for these M2 igniters for a 3.25-in. rocket. A pair of these parts is shown here



11—Cellulose acetate is used for all the parts of a assembly unit for a small Navy rocket. The container and small parts are molded while the strips are extruded

A molded igniter support and spacer disk for the Navy rocket is pictured in Fig. 9. Both are molded of ethyl cellulose. Figure 10 shows a pair of 3.25-in. rocket M2 igniters used in the Army target rocket. The function of these parts is similar to that of the other units previously described. Ethyl cellulose is the material in this instance.

The parts of an assembly unit for a small Navy rocket (Fig. 11) are made of clear transparent cellulose acetate. The container and small parts are molded, the strips are extruded.

Rear closures—Several types of rear closures are used in the rocket program for sealing the open rear end of the rocket motor against dirt, moisture and abuse. These parts are made of cellulose acetate.

There are numerous other plastic parts in production and in the development stages that fit into the rocket program. Since plastic rocket tubes have been previously discussed and since the other parts mentioned are small in volume or of a development nature, they will not be discussed here.

Naturally, the finer details of the operation of these rockets and their plastic parts cannot be discussed here, but this type of operation with rockets contributed greatly to the fall of Germany.

Resin-bonded pigment colors

by WINN W. CHASE*

THE use of pigments for coloring textiles is not new. It dates back to 400 B.C. or earlier, when earth pigments and carbon black were employed by the Chinese for producing designs on textiles by painting with brushes and printing with wooden blocks. What is new is the use of resin-bonded pigment colors for textile printing and dyeing.

This trend began less than a decade ago when, in 1937, a process was introduced for printing textiles with pigmented emulsions containing synthetic resins as bonding agents. Since then, developments in both printing and dyeing with resin-bonded pigment colors have followed one another in rapid succession. Already hundreds of millions of yards of fabrics for military and civilian use have been printed or dyed with these colors. There is every indication that in the post-war period resin-bonded pigment colors will find many new applications and will continue to grow in importance.

The quick acceptance of resin-bonded pigment colors by the textile industry is due to the fact that for many specific purposes they have numerous advantages over other types of coloring materials. Of these advantages, the most outstanding is their versatility. These colors can be applied by any one of four systems. They can be used either for printing or dyeing on cotton, jute, viscose rayon, acetate rayon, nylon, glass fiber and various other natural and synthetic fibers. Another important advantage is that resin-bonded pigment colors, when properly selected and applied, yield shades which are unrivalled in their fastness to light and enjoy excellent fastness to laundering, dry cleaning, perspiration and other destructive agencies. Furthermore, many pigment colors are extremely brilliant and others are luminescent.

The development of color application

A brief glimpse of the methods for applying pigment colors which were employed prior to the introduction of pigmented emulsions for textile printing and dyeing will give a clearer idea of the significance of resin-bonded pigment colors.

With the invention by Bell of the roller printing machine in 1783, printing of textiles passed from the handicraft stage to that of large-scale production. Following this development, Prussian blue and other synthetic organic pigments began to be used extensively in Europe for printing cotton and other fabrics. The usual method was to make the pigments into a paste with albumen, then to print, steam and dry. Steaming and drying caused the albumen to coagulate and fix the pigments on the fiber mechanically, much in the same way that pigments are fixed on canvas by drying oils. A drawback to this process was that the printed designs were not fast to repeated washings. Many attempts were made to develop binders which would bond the pigments permanently to the fibers. Materials tried, but with indifferent success, included glue, casein and varnish.

During the 1930's, use of nitrocellulose and ethyl cellulose came into vogue in this country as bonding agents for the production of lacquer prints—chiefly on rayon fabrics. The lacquer printing process resulted in beautiful sharp prints of good fastness to washing. However, when an attempt was

made to adapt this process to the printing of cotton shirtings, it was found that lacquer prints would not withstand the Trubenizing process employed for stiffening the collars of shirts. Research on this problem led to the discovery that use of certain polymerizable synthetic resins as bonding agents for the pigments enabled the production of printed designs which withstand Trubenizing and repeated launderings.

This discovery was followed by the development of pigmented emulsions containing a combination of synthetic resins, such as urea-formaldehyde resin and a modified alkyd resin, as bonding agents. With the introduction of these emulsions to the textile industry by our company, use of resin-bonded pigment colors for printing and dyeing got its real start in the textile industry.

There are four general systems for applying resin-bonded pigment colors to textiles. These are:

1. Pigmented water-in-oil emulsion system.
2. Pigmented oil-in-water emulsion system.
3. Solvent dispersion system.
4. Aqueous dispersion system.

Pigments and resins

With each of these systems, proper choice of pigments and bonding agents is essential if satisfactory results are to be obtained. Although over 1000 different pigments are known, less than 10 percent of them are employed commercially for application to textiles. Formerly, natural pigments were used; but these have been superseded almost entirely by synthetic pigments. Two factors of importance in the choice of pigments for coloring textiles are the chemical constitution and the particle size of the pigment. The fastness to light of pigments is governed by their chemical constitution. Color yield, degree of penetration and certain fastness properties are partially controlled by particle size. Fastness to washing, dry cleaning and scrubbing, and resistance to abrasion of fabrics which have been printed or dyed with pigment colors are governed largely by the bonding agent employed.

At present, three general classes of compounds are employed as bonding agents. These are synthetic resins, cellulose derivatives and starch derivatives. The synthetic resins include some thermosetting and some thermoplastic resins. Examples of thermosetting resins are phenol-formaldehydes, urea-formaldehydes, melamine-formaldehydes, alkyds, allyls, silicones and furfurals. Thermoplastic resins include the vinyls, polystyrenes, butadienes and acrylates.

Two of the factors influencing the choice of synthetic resins for use as bonding agents are their solubility in water and organic solvents, and their film-forming properties. From the viewpoint of economy, the resin should be soluble either in water or in a low-priced organic solvent. To be satisfactory, the resin must have good film-forming properties; that is, the film which is formed when the pigment-resin combination has been applied to the textile and the resin polymerized by heat should have resistance to water, alkaline soap solutions and the organic solvents used in dry cleaning. Further, the film should be strong and tough, but not too hard or brittle. It should not be too dark in color, and it should be

* Aridye Corp.

non-toxic, to avoid the danger of dermatitis. It should be stable to ultraviolet light.

Some resins are ruled out for use as bonding agents because the films fail to meet one or more of these or other requirements. For example, phenol-formaldehyde resins are usually dark in color and have a tendency to darken still more on exposure to sunlight. Frequently, a combination of two or more resins provides a more satisfactory film than does a single resin. One quite common combination is that of a urea-formaldehyde (or a melamine-formaldehyde) resin with a castor oil modified alkyd resin.

Pigmented water-in-oil emulsion system

Water-in-oil emulsions were practically unknown in the textile industry until pigmented emulsions of this type were introduced for printing in 1937. In a water-in-oil emulsion the "oil" forms the outside continuous phase, and water (in the shape of small droplets) forms the inside discontinuous phase. What is referred to as "oil" need not necessarily be an oil; it may be any liquid which in an emulsion acts like an oil. Thus, the oil phase of emulsions employed in the application of pigment colors to textiles usually consists of a synthetic resin or resins dissolved in a petroleum solvent. Pigmented emulsions are formed by dispersing pigments in the outside continuous phase of the emulsion.

The original pigmented water-in-oil emulsions have undergone a number of refinements and improvements. Today they are made in the form of 3-phase emulsions. These 3-phase pigmented emulsions are employed extensively for printing and dyeing cotton, rayon and other fabrics.

This emulsion is prepared by the printer or dyer by mixing together with a high-speed mixer a concentrated pigment color, a "clear," an organic solvent and water. The concentrated pigment color consists of a high concentration of pigment dispersed in an organic solvent solution of a synthetic resin, such as a modified alkyd resin which is soluble in aromatic hydrocarbon solvents. The clear is an unpigmented organic solvent solution of another resin, such as a modified alkyd resin which is soluble in hydrogenated petroleum solvents. The organic solvent employed in the clear usually is a petroleum solvent of the type known as safety solvents. The water should be of the usual purity and softness employed in textile processing. The emulsion is applied on an ordinary printing machine, after which the fabric is dried and subjected to a high temperature to cure the resin. It is also possible to apply the emulsions on screen-printing equipment.

Among the various types of cotton fabrics which are printed with pigmented water-in-oil emulsions are those used for shirts, dress goods, housecoats, beach coats, pajamas, underwear, draperies, curtains and ticking. Other fabrics that can be printed by this system include those made from viscose rayon, acetate rayon, nylon, even from glass fiber.

One of the advantages of 3-phase pigmented emulsions of the water-in-oil type for printing is that they provide complete fidelity of reproduction—even of photographic engravings—thus, effects can be achieved which are not possible with ordinary dyes. This opens up new opportunities to stylists and designers of printed fabrics. Another advantage, particularly important from the printer's viewpoint, is that

The variety of materials which can be printed with resin-bonded pigment colors is well illustrated here. The fabric which is pictured at the top is a sheer rayon. The next in the line of color is a delustered viscose rayon taffeta while the bottom print is a cotton voile

COLOR PLATE, COURTESY ARDYE CORP.



the final colors are seen as soon as the cloth leaves the rollers. Defects can be detected and corrected immediately.

For dyeing, 3-phase pigmented emulsions of the water-in-oil type are applied on a 2- or 3-roll padder with a good squeeze. The fabric is then predried, dried and cured.

Typical of the fabrics which are dyed with pigmented emulsions of the water-in-oil type are cotton twills, ducks, osnaburgs, canvas, netting and tape, burlap, rayon French crepes, spun-rayon sportswear fabrics, nylon mosquito netting, and glass fiber tubing and drapery materials. Because pigment colors are compatible with many of the compounds employed for rendering fabrics resistant to fire, mildew, abrasion and other destructive agencies, it is possible in many instances to combine dyeing and finishing in one continuous operation. A second important advantage of the pigment colors in dyeing is the uniformity in shade from the beginning to the end of a run. This is due to the fact that since all components of the dye liquor are taken up by the fabric in the same proportion, there is no exhaustion of the bath and, hence, no tapering off in shade as frequently occurs with soluble dyes. Furthermore, color matching is made simple.

Pigmented oil-in-water emulsion system

Pigmented emulsions of the oil-in-water type are employed for producing plain shades on cotton, rayon and other fabrics. This type of emulsion is prepared by stirring together a concentrated water-dispersible pigment color, a clear and water. The concentrated pigment color consists of a high concentration of pigment, a dispersing agent and water. The clear consists of an unpigmented oil-in-water emulsion containing a synthetic resin or resins, such as a combination of a urea-formaldehyde and an alkyd resin, dissolved in the oil phase. The solvent usually is a hydrocarbon solvent. In this type of emulsion the water forms the outside continuous phase and the oil (in the shape of small droplets) forms the inside discontinuous phase.

Pigmented emulsions of the oil-in-water type are applied on a padder in the same manner as are those of the water-in-oil type. After padding, the fabric is predried, dried and cured. Among the fabrics which have been dyed with this type of emulsion are cotton twills and acetate rayon underwear fabrics and blanket bindings. From the dyer's viewpoint, pigmented emulsions of the oil-in-water type have some advantages over those of the water-in-oil types. However, the color value of dyeings generally is weaker than is obtained with water-in-oil emulsions containing the same amount of pigment; and certain pigments do not work well in oil-in-water emulsions, tending to flocculate or to migrate from the water phase to the oil phase. Another disadvantage is that the wetting power of oil-in-water emulsions is lower, making it difficult to obtain good penetration on some fabrics.

Several patents have been issued on pigmented emulsions of the oil-in-water type for printing, but to date they have been employed only to a limited extent.

Solvent dispersion system

Solvent dispersions of pigments have been employed during the war for dyeing various types of cotton fabrics for military purposes. The solvent dispersion is prepared by mixing together a concentrated pigment color and an organic solvent. The concentrated pigment color is of the same general type that is used in making pigmented water-in-oil emulsions. The organic solvent is a petroleum solvent.

Solvent dispersions of pigments are applied on a padder, after which the fabric is dried in a dryer suitably ventilated to remove the solvent vapors. Fabrics which have been dyed

with solvent dispersions of pigment colors include shrimp netting for camouflage, duck, webbing and tape. Frequently, a mildewproofing compound and a flame-resisting compound are added to the dispersion to permit dyeing, mildewproofing and flameproofing to be carried out in one continuous operation.

Solvent dispersions of pigment colors are easy to prepare and provide good penetration. On the other hand, the color yield is lower than with emulsion systems, the fire hazard is greater and the pigments have a tendency to settle.

Mention was made earlier of lacquer printing. In that process, pigments are dispersed in an organic solvent solution of nitrocellulose or ethyl cellulose and applied on a printing machine, after which the fabric is dried. Lacquer printing is employed to a limited extent for producing novelty effects on acetate rayon dress goods and other fabrics. One drawback is that the printed parts of the fabric usually are stiff.

In a modification of the lacquer printing process, the pigment colors are dispersed in an organic solvent solution of a synthetic resin, instead of a plastic derived from cellulose. This type of dispersion has found use in printing plastic films and is being employed experimentally on other materials.

Aqueous dispersion system

Aqueous dispersions of pigment colors are employed to a considerable extent for printing and dyeing certain types of cotton and rayon fabrics. To date the bonding agents which have been most generally employed are modified starches and alkali-soluble cellulose ethers. Recently, attention has been given to the possibility of using dispersions of pigments in aqueous solutions of water-soluble synthetic resins. In one dyeing process which has been employed experimentally, the aqueous dispersion is prepared by mixing a water-dispersible pigment color in an aqueous solution of a synthetic resin (such as hexamethylmelamine) to which a thickener (such as gum tragacanth) has been added. The dispersion is applied on a padder, after which the fabric is dried and cured.

Theoretical advantages of dispersions of pigment colors in aqueous solutions of water-soluble resins include ease of mixing and application, and absence of fire hazard. The big disadvantage is that fastness to laundering and crocking is lower than can be obtained with pigmented water-in-oil emulsions.

Future of resin-bonded pigment colors

Two problems which have not yet been completely solved are: 1) the unsatisfactory fastness to washing of pigment colors when applied to wool or other animal fibers, and 2) the crocking which sometimes occurs when pigment colors are printed or dyed in dark shades. Solution of the first problem appears to call for the discovery of new or improved synthetic resins which will give a permanent bond between pigments and animal fibers. The elimination of objectionable crocking is a more complicated problem. But here again the solution seems to be dependent, in part at least, on the development of better bonding agents than those which have been available heretofore. Both problems are being attacked and already progress has been made toward their solution.

During the war, use of certain resins has been restricted to military purposes. It has been necessary, therefore, to find substitutes for use in the pigment printing and dyeing of civilian fabrics. Although some of these substitutes have been less desirable than the types of resins originally employed, others have proved to be more satisfactory. Introduction of synthetic resins with still better film-forming characteristics will permit the entrance of pigment colors into many new and varied fields.

Extrusion molding

The possibility of filling molds by extrusion has been considered from time to time, but the actuality of such a process had never been reported until recently when a molder was faced with the problem of producing an essential plastic component for an Army water filter unit, of such dimensions as to make the use of standard equipment impractical. Although many of the production details must await the war's end for release, his solution of the problem provides an interesting step in the history of extrusion molding.

He found that, because of the weight of the part, injection molding was neither feasible nor commercially possible. Therefore, he proceeded to extrude the part on a regular extruder equipped with a T head, containing a specially designed rotary valve. Together with the use of removable cavities, the machine produced a satisfactory part.

MANY visitors to extrusion plants have looked at a plastics extruder, and, as they watched the material coming out of the nozzle of the machine, have asked, "Why don't you use an extruder to fill a mold and make an injection machine out of it?" While there has been a great deal of talk about such a development, nothing has been published about the work that has been done in this field—at least not until a Cleveland molder was asked to help fill a rush order for a vital plastic component for an Army Diatomite water filter unit. While not *all* the production details of the polystyrene parts for these critical filters can be released at present, enough have now been made public to form an interesting story.

The filter and its plastic part

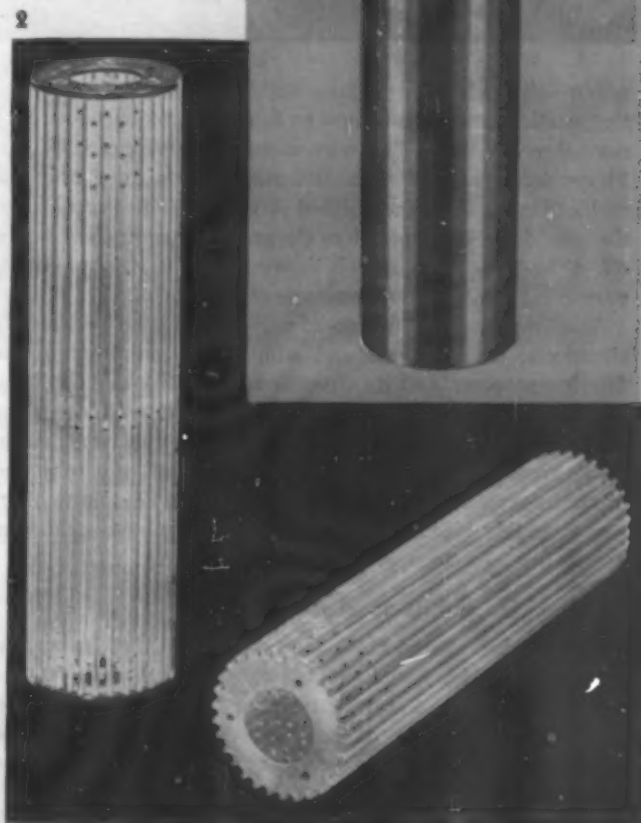
Every time troops move, no matter whether it is ten men or an entire army, fresh water is a problem. Filters must, therefore, move forward with the men, and to do this they must be available on time in the needed quantity. It was essential, therefore, that the Stellar elements for these Army filters be produced in volume, and polystyrene was found to be invaluable for a major assembly of the units. Since several plastic parts may be used in each filter, depending on the size or capacity of the unit, there was some question as to whether enough could be produced, and on time.

Due to the weight of the polystyrene part— $3\frac{1}{2}$ lb. to be exact—*injection molding* did not seem to be a feasible method of production. While there are experimental injection machines capable of making a shot of the required size, their use on this job appeared impractical, not only because they were not yet readily available commercially, but because the cycle would be too long. Not only would the material have to cool in the mold, thus tying up the machine for a long time, but only one cavity could be used. In addition, a very expensive machine would have to be used. Since such a machine would actually be producing on a 12- to 17-min. cycle, it could not meet the production requirements of the job, even if several machines were used. In this latter case, mold expense and construction problems would be multiplied. And even if the injection machines could have been installed, mold deliveries could not have been made as quickly as this development was needed for the war effort.

When finished, the polystyrene tube shown in Fig. 2 is $12\frac{1}{2}$ in. long with a 3-in. outside diameter and a $1\frac{1}{2}$ -in. inside diameter. The part weighs just under $3\frac{1}{2}$ lb., or 55 oz. After molding, the tube is subjected to several machining operations. There are 30 exterior flutes, about $\frac{1}{16}$ in. deep, spaced approximately $\frac{1}{16}$ in. apart. The flutes are milled at a high rate of speed, six tubes being milled at one time. An observer has commented that the chips come off so fast during this operation that it looks like a snow storm was swirling around the milling machine. After milling, 150 holes of approximately $\frac{1}{8}$ -in. diameter are drilled in specific positions in the bottoms of the flutes. The outside diameter of the tube is then threaded or grooved with 44 threads per inch and wound with Monel metal wire 0.020 in. in diameter. The grooves cut into the plastic serve to space the strands of wire 0.0227 in. apart.

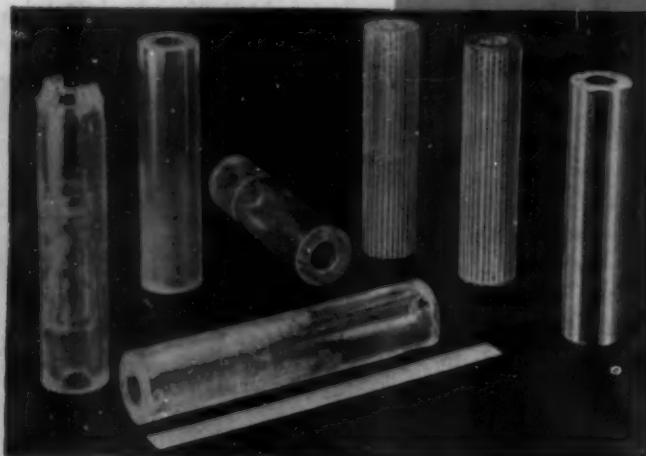
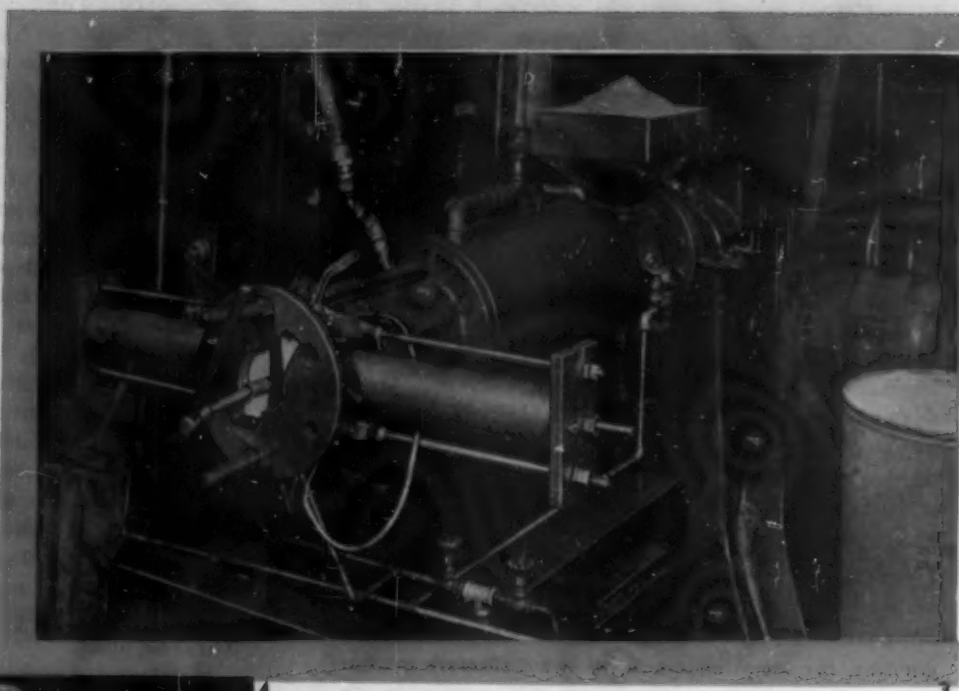
Metal caps or covers are fastened to both ends of the tube,

1—The stellar element for filter unit after plastic core is wound with wire and metal caps placed in ends.
2—Previously, 30 outer flutes were milled in and 150 holes drilled in the plastic tube



3—General view of extruder, showing special T head and rotary valve. Both molds are in position on the machine

4—Successive steps in preparing Stellar element for filter. Pieces at left show shrinkage at end of the piece which is trimmed off. Grooving, capping and winding steps follow



which help to locate the tube within the filter unit so that the plastic is not called upon to fulfill a function beyond its normal properties. The wire-wound tube is seen in Fig. 1. Figure 4 pictures the successive stages of the tube from the molding machine to the finished product and gives an idea of the size of the molding before the ends are trimmed or sawed off. The sawing operation is shown in Fig. 6, where an ordinary band saw with buttress-type teeth is used.

The low water absorption of polystyrene; its inertness to chemicals, both natural and additive, encountered in the filtering process; and its dimensional stability make it ideal for this application. Should any change take place in the plastic wherever the filter may happen to find itself, either in the arctic or in the tropics, the small strands of wire wound around the tube might be displaced, and the Diatomite filtering material, which is placed around the tubes, could then escape into the clean water system.

The machine and its operation

When asked to undertake the extrusion of these tubes, the Cleveland molder found that all conventional methods used for the extruding of styrene tubes of the size and shape described above were out of the question. It was obvious that the annealing of the tube, necessary because the section was so heavy, was to be a major problem in the production of a perfect section. A solution was found in the use of removable

cavities. Figure 5 shows an operator removing the filled mold from the machine.

A special T head, to be seen in the general view of the extrusion molder in Fig. 3, was developed for one of the company's 2½-in. extruders. The head contains a specially designed rotary valve for directing the material to the right- or to the left-hand mold. After the material enters the valve, it passes through a spreader section, then through a ring gate into one of the molds which are fastened to the T head to receive the material.

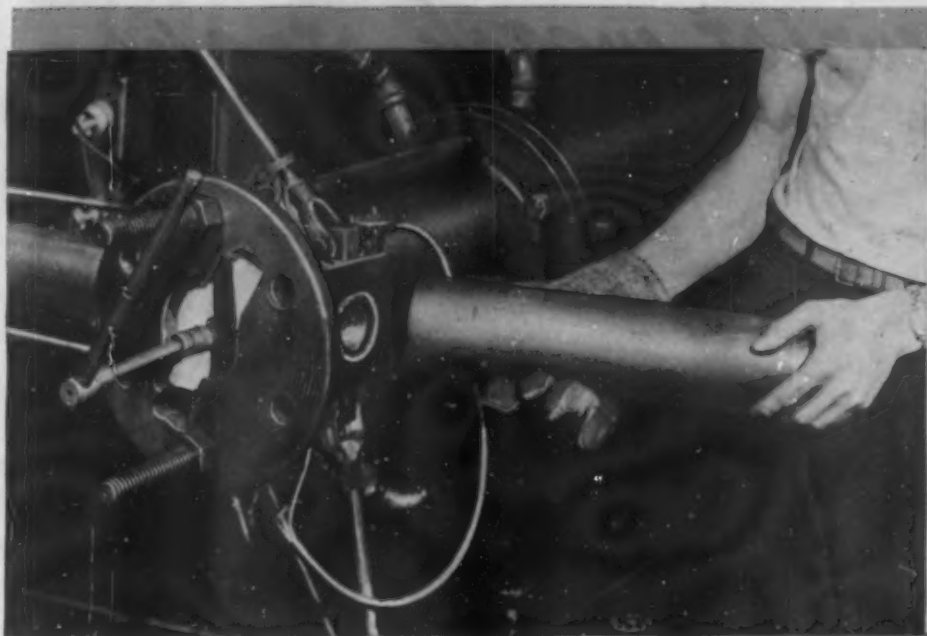
The molds for this filter part are made of sections of seamless steel tubing. A bracket which supports the internal mandrel or insert is fastened at the outer end of the mold. The mandrel is supported in a cone-shaped depression in the center of the spreader section of the T head on the opposite or injection end of the mold.

The material enters the mold through a ring gate slightly smaller in size than the tube itself. About 5 to 5½ min. are required to fill the mold. As soon as one mold is filled the rotary valve is turned and the opposite mold begins to fill. Meantime, the first mold is removed from the machine by loosening the nuts on the supporting strain rods, and is replaced by an empty mold.

Directly after the molding operation, the center mandrel is removed by process of chilling it, and then pressing it out on an arbor press. The mold containing the tube is then subjected to an annealing process which allows the thick section to cool slowly and at a rate calculated to eliminate molding strains and to produce a clear and bubble-free molding. After the annealing process, the tube can be removed from the mold by a gentle tapping. The mold is then ready for re-use.

At the outset of the development, the mold and mandrel were greased with mineral oil, silicone compounds and other mold lubricants. But once it was discovered how the material flowed as it filled the piece and once the correct molding temperatures were worked out, this became unnecessary.

The main molding problem encountered in this development was that of controlling the shrinkage of the molding. On this particular job, the external and internal shrinkages must be closely controlled. This control is made possible by the annealing process and by a special treatment given to the



5—Operator removes mold from extruder while opposite mold is being filled. Mold and molding are then cooled and annealed to remove strains and confine shrinkage to ends

6—Shrinkage is confined to ends of molding. After the annealing process, the ends of the 55-oz. molding are sawed off

ends of the tubes which cause residual shrinkage to take place not away from the walls of the tube but from the ends of the molding toward the center of the section. Since the ends of the tubes are cut off later on (Fig. 6), the sections where the shrink marks or bubbles are most likely to be found are not part of the finished piece. Thus a perfect tube is produced.

The molds used for the production of these tubes are vented on the outer ends so that the operator can observe when the mold is full and throw the lever controlling the rotary valve inside the T head so that the opposite mold can be filled. The advantage of the T head, on which design and other patents are pending, is that the extruder may be run continuously and production is uninterrupted. This is unlike the intermittent production obtained where the screw must be stopped, bled or even backed up while the molding is being cooled or removed from the machine. There is no waiting for the material to set in the cavity since the cavity is removed from the machine and subjected to an individual annealing process. This process has put thousands of pounds of plastics directly to work in the war effort on parts that could not have been produced by any other generally known means on the schedules laid down for this molder.

The process has been used to shoot as high as 8 lb. (128 oz.) of material in successive cycles of around 6 to 8 minutes. Such fast cycles are possible on the heavy or solid sections of the filter mainly because the material in the molds may be slowly cooled under carefully controlled conditions outside of the machine while the extruder is filling another cavity. About six to eight molds are used to produce the tubes described in this article at the rate of one tube every 5 minutes.

The advantage of having the injection proceed on a constant basis is obvious. Only by constant operation of the extruder can maximum efficiency and production be obtained. Since the pressures are not excessive—the material having been thoroughly plasticized before it enters the mold—it is not necessary to provide the usual massive clamping device found on the large injection machines.

Experimental production

Experiment has shown that shapes other than the one shown here may be molded by this process, and in relatively



inexpensive molds. Among the projects on which development work is going forward is that familiar bug-bear of the plastics industry—the battery box. The extrusion molding process described in this article is experimental only in the sense that other processes for obtaining large shots of thermoplastics are still experimental. It has probably been used to produce more pounds of commercial moldings than any other 3-lb. injection machine today—and that on a \$5000 extruder. The method is not, however, a cure-all for the successful molding of heavy sections. It is merely one solution of an unusual problem with which an individual molder was faced. It does serve to point the way for the possibilities latent in this type of molding.

Credits—Material: Styron. Molded by Carter Products Corp. for Inflico, Inc.

Molded wrist watch straps

One of the unique features of these polythene wrist watch straps is the snap fastener which is molded into both the one- and two-piece models. The one-piece strap slips between the watch pins and the watch, running beneath the back plate



two drawbacks to this style as far as its use by members of the Armed Forces is concerned. If either of the tiny spring pins by which such a strap is secured fails, the watch may well be lost. Furthermore, the task of removing these pins to replace a strap should not be attempted on a battlefield or even in a barracks. As at home, the job is one for a jeweler. With all these disadvantages in mind, the company also undertook to produce a one-piece strap which completely encircles the arm, running under the watch, over the pins and on around the wrist. This construction throws all the strain upon the wrist watch strap and removes it from the two delicate watch pins.

But before production could be undertaken there was yet another design problem to be solved. Metal buckles were practically unobtainable; so were snap fasteners such as are used on gloves. At this point the research laboratory stepped in with the idea of molding the male and female parts of a snap fastener as integral parts of the strap. The only difficulty was that even with these raised areas the straps, measuring $9\frac{1}{2}$ in. in length, had to be held throughout their entire length to a thickness of not over 0.038 in. so they could slip easily between the watch housing and the spring pins.

A trial and error period

A variety of plastic materials were tried out on the first single-cavity experimental mold, but without success. No completed straps were produced. This failure was due to the thinness of the mold, 0.038 in. to be exact. Before the plastic could flow through this restricted section and completely fill the mold, the plastic started to set up, blocking the injection of the rest of the shot. Different heats and pressures on both the mold and the injection cylinder were tried but to no avail. Seemingly as a last resort, polythene was suggested—and the result was the Pla-Safe strap in which the snap fasteners are integral parts of the strap.

Polythene, like nylon, has the highly unusual physical property of orientation. A fiber of nylon, which has been made under low tension, can be drawn to approximately four times its original length when subjected to further tension.

THERE have long been wrist watch straps fabricated from leather, plastic, metal and cloth. But a strap molded from polythene—that's news. In a wide variety of colors these molded straps are just now being introduced in one and two-piece styles in $\frac{5}{8}$, $\frac{9}{16}$ and $\frac{11}{16}$ in. widths.

These molded polythene watch straps are designed to meet the most exacting wear requirements, both of our men overseas and of workers in heavy industry. But at the same time the straps are expected to find a ready market with the white collar worker and with women in industry and in the home because of their attractive appearance and ease of attachment.

Leather straps absorb perspiration odors and fungus, and are adversely affected by salt air, humidity and exposure to the weather. Their stitching often rots away allowing the strap to come apart. In contrast, the polythene straps withstand without deterioration the varied conditions under which we must live and work; they neither rot nor become stiff when subjected to extremes of temperature.

Problems of design

The first design was for a two-piece strap. But there were

This is explained, in brief, by the fact that the long chain molecules that make up the undrawn fiber have a haphazard arrangement. But upon drawing, these molecules become oriented, taking on an orderly parallel arrangement. Polythene acts in much the same way.

It was discovered that when polythene was injected into the watch strap mold, the finished strap, for some unknown reason, had the physical properties of an oriented fiber. At the time the explanation was anyone's guess. However, it now appears that through the process of injection molding a thin cross section, such as a 0.038-in. thick strap, the long chain molecules of the polythene were forced into an oriented pattern.

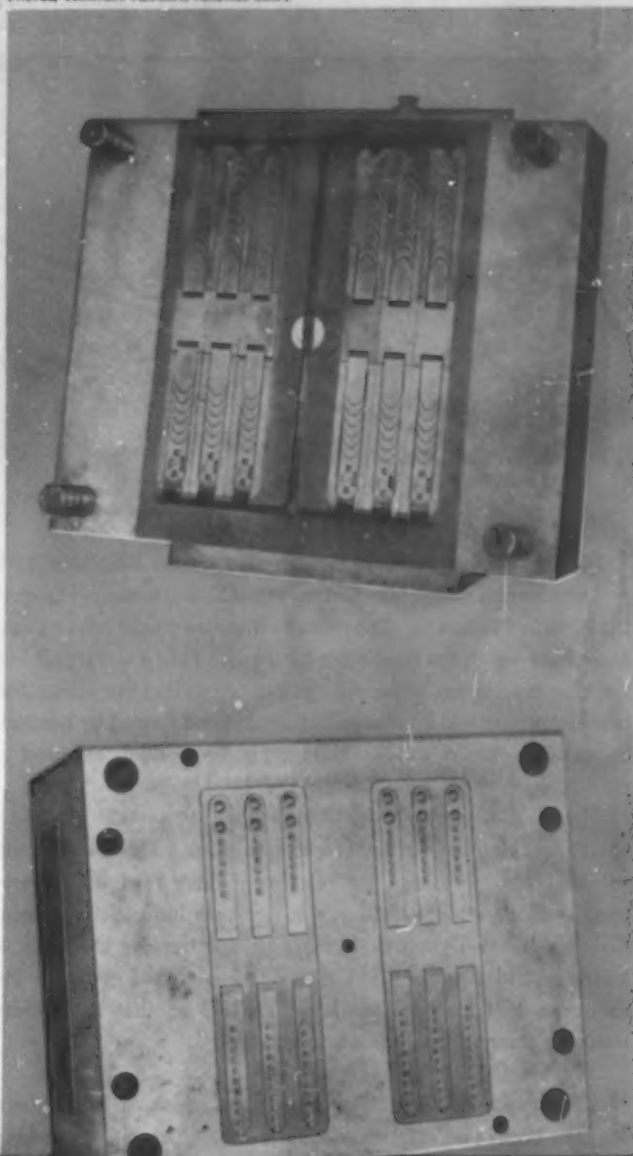
With the problem of a suitable material safely out of the way and with the molding technique thoroughly mastered, thanks to the cooperation of the material manufacturer, a 6-cavity production mold was undertaken. Four of the six cavities were for the $\frac{5}{8}$ -in. wide straps, one was for the $\frac{9}{16}$ -in. strap and one for the $\frac{11}{16}$ in. width.

The straps are molded on an 8-oz. injection machine; a pressure of about 18,000 p.s.i. being maintained on the ram. Some difficulty was encountered with the clamping pressure but this was finally overcome by the proper alignment of the cavities. All sprues, gates and runners are, of course, rerun with no sacrifice of properties in the finished product since no chemical action occurs in either the die or the cylinder.

To make the straps available to all types of outlets, the company has designed a wide array of packages. The one-piece straps are either mounted on round boxes or on individual paper cards, or on easel-type display cards. The two-piece straps, on the other hand, are packaged in individual boxes. The molded straps are covered by letters of patent in both the United States and Canada, and other patents are pending.

Credits—Material: E. I. du Pont de Nemours & Co., Inc., polythene. Molds by Plastic Mold and Die Co. Straps molded by Nosco Plastics Co. for Plastic Products Development Co., owner of patents. Straps distributed by Pla-Safe Plastics Corp.

2 PHOTOS, COURTESY PLA-SAFE PLASTICS CORP.

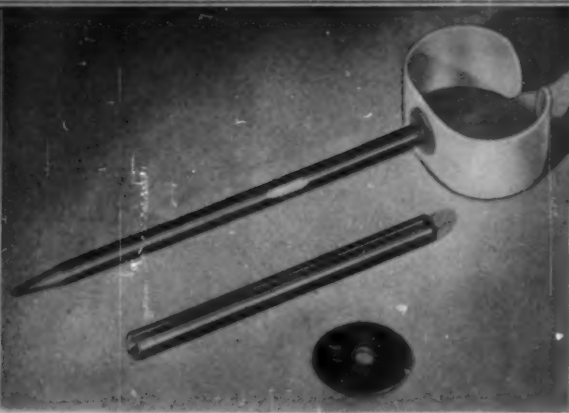


3

2—Two-piece polystyrene straps are molded in 12-cavity dies. Ultimately the straps will be molded in a wide range of colors

3—Advantages of polystyrene for these straps are its excellent flexibility, great strength and resistance to perspiration and extremes of climate





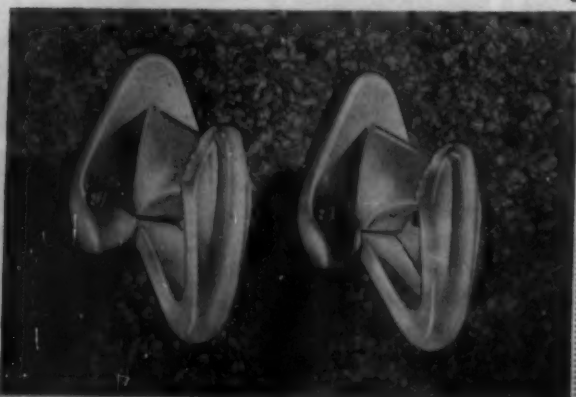
1

1 Many a knotty problem is unsnarled by the Respindle yarn winder and holder which Merit Mfg. Co. fabricates of Fibestos, Lumarith or Plastacele. The holder comprises a bracelet and rod, and a tube which fits loosely over this rod. Thus a slight pull sets the tube to spinning, either winding or unwinding the yarn. The bracelet is punched from sheet stock and hand formed by heating. Superior Plastic Co. supplies the tube and rod which are used in production of these handy winders

2 For making emergency power connections, Graybar Electric Co., Inc., furnishes the Portsmouth Navy Yard with a serviceable Bakelite tool handle which Northern Industrial Chemical Co., molds around a metal insert by the transfer method. A knurled band circling the handle ensures a solid grip and the shock-resistant material insulates the tool so that its wielder won't be stunned by the electric current

3 When you hang an apron on a Ketchhook, it stays hung. The hook, a product of Plastic Die & Tool Corp., has a locking device which grips the article securely until it is lifted, thus releasing the catch. Molded of Tenite or Lumarith, the hook is built for hard use

4 Damage to the intricate mechanisms of landing gear of a plane in storage is prevented by bands of Lucite which are clamped around the plunger of the landing gear strut. The bands,



3



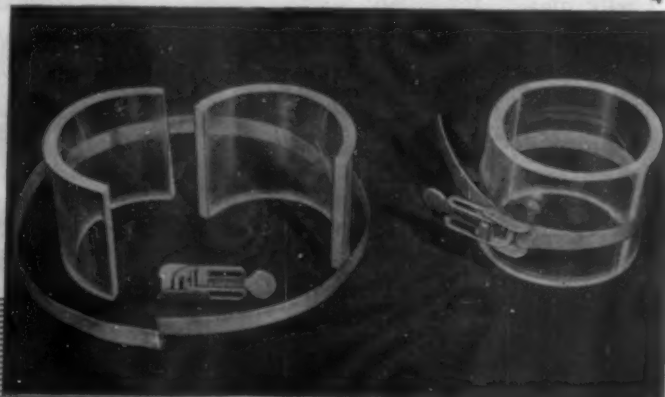
2

designed by the San Bernadino Air Technical Service Command, act as a stop and support the weight of the plane. The transparency of the plastic simplifies checking of the hydraulic fluid. A wrap lock holds the two halves of the band together in assembly

5 Hobby-minded J. Fred Williams, at his home in California, hand fashions string instruments like this ukulele from Lucite or Plexiglas. Sheets of the acrylic are cut to size, heated, shaped and cemented together. The completed instrument is a thing of beauty and utility

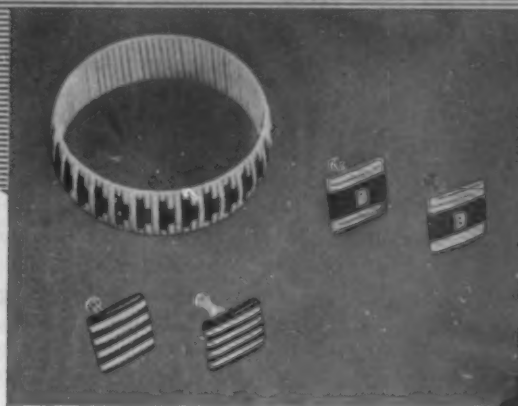
6 Clever designing by Louis Edman brings a new twist to plastic coated cotton thread, producing smartly striped matching earring and bracelet sets—gay accessory jewelry. They are hand braided from Cotalace over a clock spring steel base. The end of the coated thread is cemented in place

7 Postwar auto trips with Little Johnny can be a pleasure with "Half Pint" along to take care of his needs. Injection molded of Tenite by Anfinson Plastic Molding Co. for Givens & Co., the



4

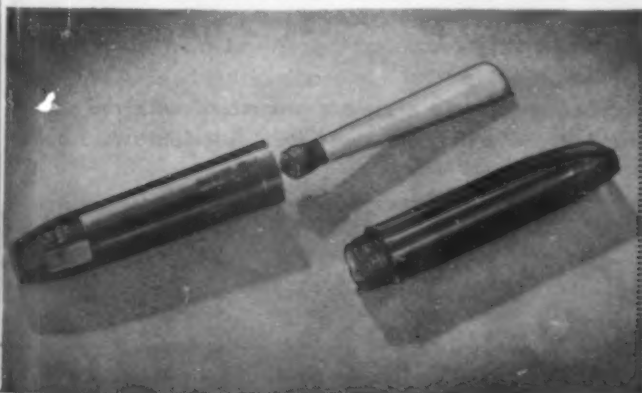
PLASTICS IN REVIEW



four separate parts are glued together. The receptacle was designed especially for plastics

8 Babies cry for rattles like these, molded of transparent Lumarith by Aard Co. The sound effects are created by bits of macaroni supplied by Waco Bread Co. which are dyed with certified food color. The body and handle of the rattle are molded separately and the two halves of the rattle proper cemented and crimped together

9 Tip for a typist with troubles, the Rush-FybRglass eraser removes errors on a letterhead without smearing the carbon copies beneath it. The case of translucent red Tenite II is molded for Eraser Co., Inc., by Plastics Div., National Organ Supply Company. Thousands of finely spun glass fibers make up the brush tip. A number of extra glass fiber erasers are supplied with these attractive plastic holders



Seeing . . . with and without light

by WILLIAM J. CONNELLY*

With due care in the selection of the plastic and the methods of mixing and processing, luminescent pigments are being successfully incorporated in both thermoplastic and thermosetting materials

EXPERIMENTS, particularly during the years of the war, have disclosed the possibility of advantageously incorporating luminescent pigments with many of our plastic materials. In this way we are able to find things in the dark, provide light that is easy on the eyes, aid safety and product identification, and produce unusual decorative effects, to mention but a few possible applications. The phenomenon of photo luminescence—phosphorescence or fluorescence—in which some form of radiant energy, usually ultra-violet light, is absorbed and then re-emitted as light of a longer wave length has, however, been known for many years.

Phosphorescence differs from fluorescence, which all luminescent pigments possess, in that the pigment has the property of emitting luminescent light after the exciting light source has been removed. In this respect, they may be likened to storage batteries which, after being charged, give off their energy over a period of time. Fluorescent pigments, on the other hand, emit luminescent light (cold light—not due to incandescence) only when exposed to a "black" light.

While in nature there are many materials and substances which are luminescent, we are concerned here with the inorganic, chemical luminescent pigments produced today in commercial quantities. They consist of sulfides of zinc, cadmium, calcium or strontium and cover a wide range of colors. They are divided into two groups: fluorescent and phosphorescent. In contrast to radium-activated pigments which contain their own activator, these inorganic, chemical pigments must be activated by a source other than themselves.

The proper pigment with the proper plastic

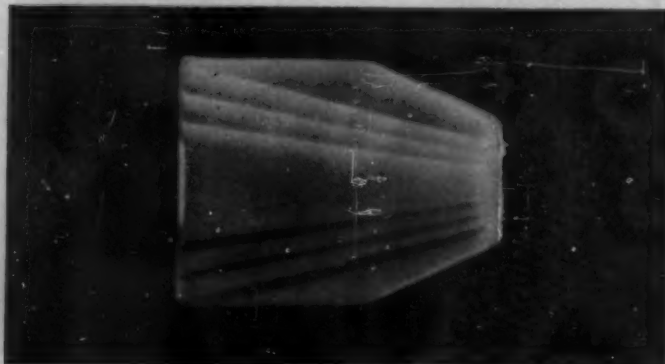
The luminescent pigments are produced by combining the specific sulfide with a small amount of a metallic activator, such as silver, and then calcining (oxidizing) at a high temperature. This produces a crystalline structure which, while quite small in the case of fluorescent pigments, is large enough in phosphorescent pigments to cause trouble when these pigments are combined with other materials such as plastics.

Calcium and strontium sulfide phosphorescent pigments

* Manager, Consumer Relations Div., Bakelite Corp.

A light plug is as easy to find at night as in the daytime when luminescent pigments are mixed with the plastic material. The pigments should be combined with the plastic at the mill to assure even pigment distribution

PHOTOS, COURTESY BAKELITE CORP.



are subject to attack from both moisture and acid. For this reason, a number of the conventional phenolic, melamine and urea compounds have not proved too successful as a medium for these particular pigments. However, some success has been achieved with more recent types of thermosetting materials, such as certain contact-pressure resins. Other luminescent pigments such as the zinc and cadmium sulfides may, because of their stability, be used with these resins.

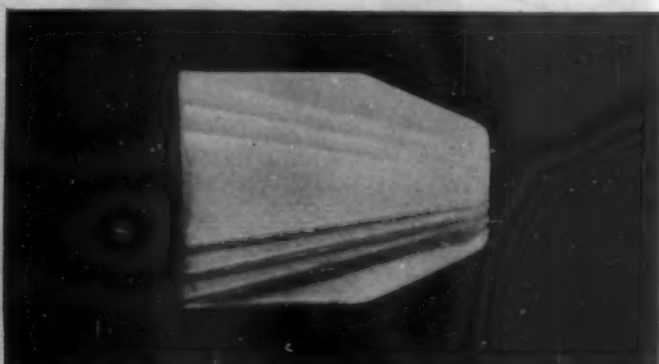
On the whole, thermoplastics have been the more suitable medium for luminescent pigments. The vinyls, polystyrene and methyl methacrylate are the three best for the purpose in this field. Two important factors—light stability and light transmission—play an important part in the selection of the type of plastic in which to incorporate luminescent pigments.

The amount of pigment necessary to give satisfactory luminescence in a plastic is largely controlled by two considerations: the thickness of the item and whether the object is to be fluorescent or phosphorescent. Very naturally, thin-walled objects need more pigments in relation to the weight of the plastic than do thick-walled objects. In fluorescent objects $2\frac{1}{2}$ to 5 percent of pigment may be considered adequate. On the other hand, to obtain a proper degree of phosphorescence, 7 to 10 percent by weight is a more representative figure.

Generally, the use of other pigments with luminescent pigments is not desirable. However, fractional percentages of soluble dyes may be added to provide pastel daylight colors without seriously affecting the luminescence of the other pigments. The incorporation of other compounds composed of lead, iron or cobalt has a definite detrimental effect on the luminosity of the pigments since they are not compatible.

The time of mixing and processing

Luminescent pigments, both fluorescent and phosphorescent, should be incorporated in plastic molding materials at the mill or Banbury mixer. It is not enough to mix in the pigments with the molding granules just before molding since such a practice results in spotty distribution of the pigment. In the case of phosphorescent pigments, care must be taken that the crystals composing the pigment are not broken down





This day and night view of an average postwar home shows a few of the possible applications for fluorescent and phosphorescent pigments which are both decorative and practical—pointing out danger points

and consequently destroyed. The crystals, while only from 5 to 40 microns, should not be ground or ball-milled. On the other hand, fluorescent pigments, which are in some cases 40 times smaller in structure than the phosphorescent pigment crystals, may be safely milled like any other pigment.

When relatively large amounts of luminescent pigments are incorporated in plastic materials a tendency toward scorched moldings is sometimes noticed. Under these circumstances it is advantageous to keep molding temperatures as low as is consistent with the complete filling of the mold cavity in the case of injection molded thermoplastics and with a practical molding cycle in the case of thermosetting plastics. Proper lubrication of the molding material helps considerably.

Luminescent plastics have been successfully processed by compression and injection molding, by extrusion and casting. And since the recent introduction of vinyl resin¹ plastisols, luminescent materials have also been successfully low-pressure molded. Since plastisols consist of resin suspended in plasticizers, it is only necessary to stir in the pigments.

In the field of calendering, rigid sheets, flexible sheeting and film- and cloth-coated fabrics have all proved to be successful mediums for this pigmentation. In phosphorescent cloth coatings, it is always well to use white cloth as backing. The white serves as a reflector and aids in obtaining the brightest possible coloring. Films and coatings are rendered more effective and lasting by overlaying with a thin, clear film which serves two purposes.

How long will luminescent pigments last? The answer is—it all depends. The number of times a plastic part is activated has no effect on the pigments. Rather, it is chemical

change which governs the effectiveness of luminescent pigments. Properly compounded materials, suitably protected, have given no sign of deterioration after many years' service.

Today, the luminescent pigments are devoted to essential war work—the largest tonnage being used in making paper for aviators' maps. They are also being used in phosphorescent tapes, $\frac{3}{4}$ in. wide in amounts up to 4000 yd. per ship, to mark interior passageways in merchant ships traveling blacked-out in a convoy.

The future of luminescent plastics

Utilizing resins such as polystyrene, plastic paints have been developed which incorporate phosphorescent pigments. These paints prove to be very stable and they should find many decorative and industrial applications.

The effectiveness of fluorescent pigments in airplane instrument panels has been carefully studied by the automotive manufacturers. It is possible that in the postwar car plastic instrument panels will contain luminescent pigments. Study of parallel applications in the radio field, in cabinet fronts and dials, is also progressing.

The development of the pigments in vinyl resin plastisol suggests all manner of elastomeric knobs, handles and floor plugs. The expected popularity of television opens a broad field for decorative parts which can be used as guides in the darkness essential for good television reception. The television set itself, the furniture, accessories such as telephone handsets, switch plates, ash trays, the drapes—yes, even the wallpaper—are fertile fields for the plastics industry and luminescent plastics.

¹ Vinyllite, product of Bakelite Corp.

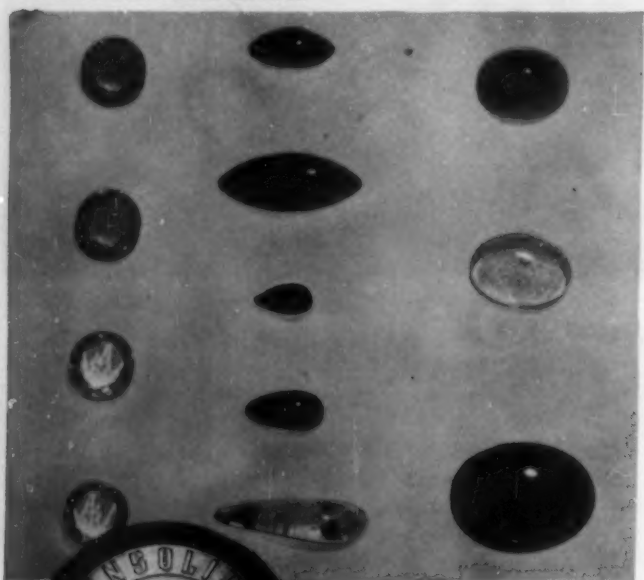
Molding methyl methacrylate resins

by M. L. MACHT*

DESPITE wartime preoccupation with production of adequate quantities of methacrylate molding compounds for the military services, substantial advances have been made in improving the quality of these products. These advances have been as important to the war effort as the production of the desired quantities of material in that, on the one hand, they permit the molding of military items of a quality that could not have been achieved previously and, on the other hand, make possible the more economical molding of articles of ordinary quality. Advances have been so rapid

* Technical service director, Technical Service Dept., E. I. du Pont de Nemours & Co., Inc.

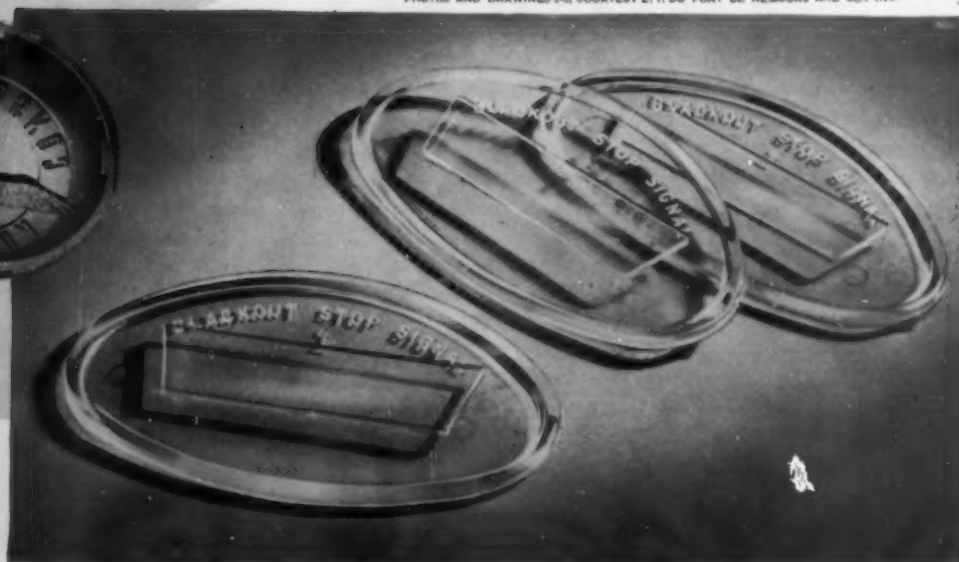
PHOTO, COURTESY STANDARD PLASTICS CO.



1



2



that A.S.T.M. Specification D 788-44 T, which outlined the best that could be expected at the time of its issuance in June 1944, can today be exceeded in many of its requirements and is consequently in process of revision.

As a result of past experience, molders had learned that high injection pressures (about 25,000 p.s.i.), high injection temperatures (about 500° F.), and extremely large gates and runners were required for best results in molding methacrylates. These factors are still of major importance for the most heat-resistant grades of this material, such as an H-flow (332 ± 9° F., A.S.T.M. method D 569-43). But it is feasible, and in some instances desirable, to modify these grades to a certain degree with softer materials such as the M-flow (300 ± 9° F.) and the S-flow (279 ± 9° F.). Further, the use of relatively hot dies, such as will be described later, tends to reduce the importance of high pressure, high temperature and extremely large gates, runners and sprues. Consequently, while a strict adherence to the use of the preferred equipment and the techniques outlined below will yield the best possible results—is in fact, essential in extremely critical applications such as in the manufacture of lenses or heat-resistant military parts—it is also feasible in a number of cases to mold consumer merchandise of an average quality without resort to the more desirable specialized equipment or techniques.

Methacrylate molding compounds are most widely worked by the injection technique (1).¹ For that reason, the major portion of this paper will be devoted to injection technique and injection compounds. Some comments and data will be given on the compression molding of these materials.

¹ The figures in parentheses refer to listings in the Bibliography appearing at the end of this article.

Improvement in quality of methacrylate molding compounds is seen in (1) brilliant cut stones from S-flow resins. Again, from M-flow material come such items as plane control knobs (2) and standard blackout lenses (3)

PHOTOS AND DRAWINGS 2-4, COURTESY E. I. DU PONT DE NEMOURS AND CO., INC.

3

Improv
Gener
materi
meets
fication
been c
relativ
at low
sirable
fication
sistance
where
and wh
is indic
handles
brilliant
tional,
index o
material
made b
methac
some o
applicat
general
Gener
eral-pur
M-flow
which v
D 788-
propert
field wh
with a
or runn
such as
ments,
proved
cally res
depicts

² Lucit
³ Lucit

Additio
molding
(4) a s
tri-color

4

Improved molding powders

General-purpose S-flow—Improved general-purpose S-flow material (279 ± 9° F., A.S.T.M. method D 569-43) which meets or exceeds all of the requirements of A.S.T.M. Specification D 788-44 T, type 1, is currently available.² It has been compounded especially for the injection molding of relatively thick articles through gates of small cross section at low cylinder temperatures. In order to attain these desirable characteristics, it was necessary to make certain modifications in formulation which somewhat impair heat resistance. Consequently, this material is recommended for use where ease of molding is the most important consideration and where heat resistance is not of prime importance. Its use is indicated for articles such as jewels, compacts, hairbrush handles, decorative knobs, buttons and plaques. The brilliance of gems made from material of this type is exceptional, provided the design has been soundly based upon the index of refraction and the dispersion characteristics of the material (5). Cut stones such as shown in Fig. 1 have been made by several molders. The fact that the resistance of methacrylate to abrasion and marring is superior to that of some of the cheaper materials which have been used in this application results in a product which is more suitable for general use and which is meeting with wide acceptance.

General-purpose M-flow—A somewhat harder-flowing general-purpose material, which can be best characterized as an M-flow (300 ± 9° F., A.S.T.M. method D 569-43) and which will exceed the requirements of A.S.T.M. Specification D 788-44 T, type 2 or type 4, is also now available.³ Its properties make it most suitable for use in the industrial field where a fair degree of heat resistance is required, along with ability to be injection molded through rather small gates or runners. The use of this material is indicated for articles such as the horn buttons, tail light lenses and radiator ornaments, so widely used in the automotive industry. It has proved well suited to the molding of flash light lenses, chemically resistant machine parts, and instrument cases. Figure 3 depicts a standard military blackout lens which is currently

² Lucite HM-130.

³ Lucite HM-129.

Additional applications in which methyl methacrylate molding powders have met with outstanding success are (4) a sealed beam headlamp lens and (5) an airport tri-color lens formed of heat-resistant H-flow material

being manufactured from a powder of this variety; Fig. 2, a control knob similar to horn button moldings such as will be made from this material after the war.

Heat-resistant H-flow—An H-flow (332 ± 9° F., A.S.T.M. method D 569-43) heat-resistant material which will exceed the requirements of A.S.T.M. Specification D 788-44 T, types 2 and 4, is also available at the present time.⁴ This material is so much better than earlier products that the current A.S.T.M. specification is being revised so that it will describe more accurately the commercially available materials. Articles molded from this formulation are outstanding because of their resistance to high temperatures. The material's rigidity at high temperatures is so good that it has proved satisfactory in a number of applications which were previously thought to require heat-setting compounds. Its use is indicated for articles requiring maximum resistance to high temperatures, such as electrically illuminated signs, surgical instruments, medical appliances, military battery cases and certain types of instrument parts. Applications in which a material of this type has met with outstanding success are the Maritime Commission sextant, airport landing lenses (Fig. 5) and headlamp lenses (Fig. 4) such as are used on the Army "duck."

Properties—In Table I, the properties of S-flow, M-flow and H-flow materials are shown in comparison with those of an earlier M-flow material.⁵ The earlier M-flow serves as a standard of reference and permits one to judge the suitability of any of the new formulations for applications where the older compound has been used previously.

Injection equipment

Injection molding machines—Any of the commercially available domestic injection molding machines (1, 2) can be used satisfactorily in the molding of methacrylate compounds. Most of these machines can be used without modification for the production of ordinary civilian articles; but some of them, particularly the older models, require modernization if the lowest possible cost and the highest possible quality are

⁴ Lucite HM-122.

⁵ Lucite HM-102.

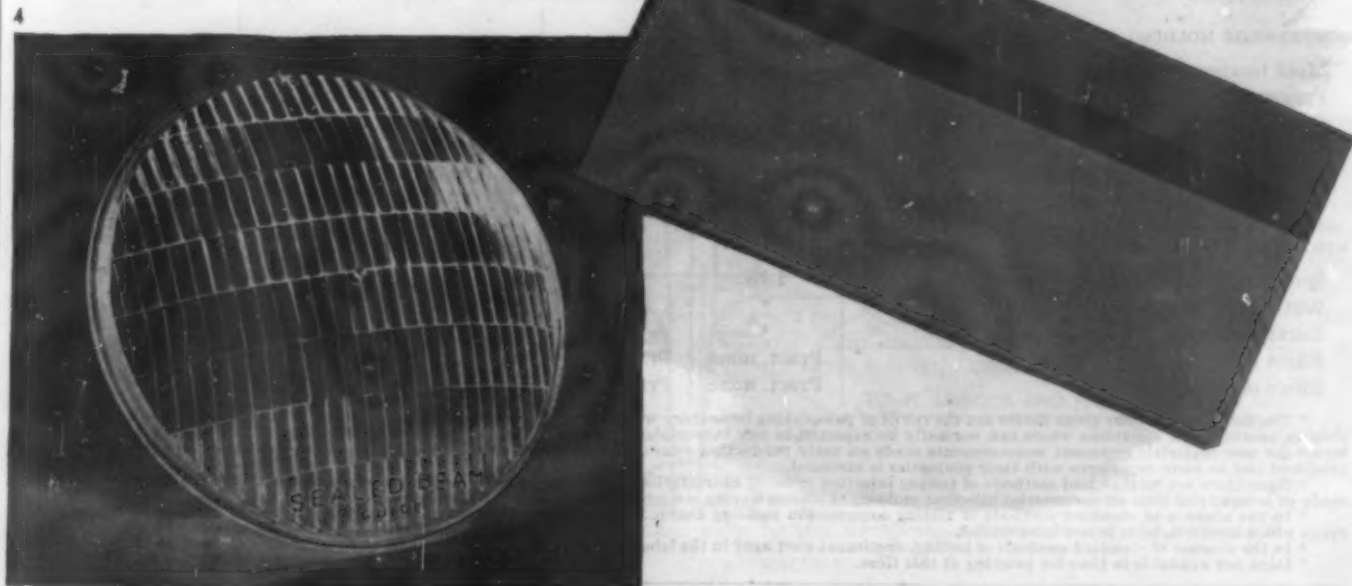


TABLE I—PROPERTIES OF METHACRYLATE MOLDING COMPOUNDS

Property ^a	General purpose			Heat-resistant	Test method
	S-flow	New M-flow	Previous M-flow	H-flow	
MECHANICAL					
Tensile strength, -70° F. p.s.i.	•	•	14,000	15,000	A.S.T.M. D 638-42 T
77° F. p.s.i.	8500	9000	8500	10,000	A.S.T.M. D 638-42 T
170° F. p.s.i.	•	•	3500	5000	A.S.T.M. D 638-42 T
Elongation, -70° F. percent	•	•	0.5	<1	A.S.T.M. D 638-42 T
77° F. percent	2.5	2.5	2.3	3.	A.S.T.M. D 638-42 T
170° F. percent	•	•	14.	20.	A.S.T.M. D 638-42 T
Modulus of elasticity, 77° F. p.s.i.	400,000	400,000	400,000	400,000	A.S.T.M. D 638-42 T
Flexural strength, 77° F. p.s.i.	15,000	16,000	14,700	19,600	A.S.T.M. 650-42 T
Impact strength, Izod, ft.lb. per in. of notch (min.)					
-70° F.	•	•	0.26	0.30	A.S.T.M. D 256-41 T
77° F.	•	•	0.44	0.40	A.S.T.M. D 256-41 T
170° F.	•	•	0.40	0.50	A.S.T.M. D 256-41 T
Rockwell number	M 99	M 103	M 102	M 112	A.S.T.M. D 229-43
Mar resistance, percent	60	60	60	60	A.S.T.M. D 673-42 T
THERMAL					
Coefficient of linear expansion 0 to 25° C, per °C.	7×10^{-5}	7×10^{-5}	7×10^{-5}	7×10^{-5}	A.S.T.M. D 696-42 T
Thermal conductivity, cal./cm. ² /sec./°C./cm.	6×10^{-4}	6×10^{-4}	6×10^{-4}	6×10^{-4}	Cenco-Fitch apparatus
Btu./ft. ² /hr./°F./in.	1.8	1.8	1.8	1.8	
Heat distortion temperature, °C., 264 p.s.i. stress	65	71	70	92	A.S.T.M. D 648-44 T
66 p.s.i. stress	•	•	78	102	A.S.T.M. D 648-44 T
Flow, °F.	279 ± 9	294 ± 9	280 ± 9	332 ± 9	A.S.T.M. D 569-43
°C.	137 ± 5	146 ± 5	138 ± 5	166 ± 5	A.S.T.M. D 569-43
Deformation under load at elevated temperatures, percent	•	•	12.0	2.0	A.S.T.M. D 621-43 T
OPTICAL					
Index of refraction	1.49	1.49	1.50	1.49	A.S.T.M. D 542-42
Light transmission, total visible 0.125 in. thick, percent	91	91	91	91	Physical photometer illuminant "C"
ELECTRICAL					
Dielectric strength, short time, v./m. 0.125 in.	400	400	400	400	A.S.T.M. D 149-40 T
Dielectric constant, 60 cycle	•	•	3.5	3.5	A.S.T.M. D 150-42 T
10 ⁶ cycle.	•	•	2.8	2.9	A.S.T.M. D 150-42 T
Power factor, 60 cycle	•	•	0.05	0.06	A.S.T.M. D 150-42 T
10 ⁶ cycle	•	•	0.018	0.02	A.S.T.M. D 150-42 T
INJECTION MOLDING					
Die temperature, °F.	120-130	125-155	125-145	180-220	b
Cylinder temperature, °F.	380-420	400-440	380-420	440-480	b
Pressure, p.s.i.	17,500-22,500	20,000-25,000	20,000-25,000	20,000-30,000	b
COMPRESSION MOLDING					
Mold temperature, °F.	280-300	290-330	290-330	300-350	c
Pressure, p.s.i.	2000-10,000	2000-10,000	2000-10,000	2000-10,000	c
Cycle, 0.125 in. thick, min.	2-5	2-5	2-5	2-5	c
1.000 in. thick, min.	45-75	45-75	45-75	45-75	c
Mold shrinkage, in./in.	•	•	0.005	0.003	A.S.T.M. D 551-41
Apparent density	•	•	•	•	A.S.T.M. D 392-38
MISCELLANEOUS					
Specific gravity (molded)	1.18	1.18	1.18	1.18	A.S.T.M. D 71-27
Water absorption	•	•	0.3	0.3	A.S.T.M. D 570-42
Burning rate, in. per min., 0.125 in.	•	•	1.5	1.4	A.S.T.M. D 635-41 T
Effect of age	Pract. none	Pract. none	Pract. none	Pract. none	d
Effect of sunlight	Pract. none	Pract. none	Pract. none	Pract. none	d

^a The data and opinions given herein are the result of painstaking laboratory work. However, differences in technique or in operating conditions from one shop to another, and variations which can normally be expected in any thermoplastic material, may cause deviations from the figures given. Data reported herein for new materials represent measurements made on early production runs and are subject to modification as larger quantities of these materials are produced and as more experience with their properties is obtained.

^b Since there are no standard methods of testing injection molding characteristics, the figures given herein represent average data resulting from moldings made in a variety of dies, on commercial injection molding machines having straight bore material cylinders and conventional spreaders.

^c In the absence of standard methods of testing compression molding characteristics, the data given herein were the result of molding in dies of several types which were available in our laboratories.

^d In the absence of standard methods of testing, specimens were aged in the laboratory and exposed to sunlight at Arlington, N. J., and at Hialeah, Florida.

^e Data not available in time for printing at this time.

to be achieved. The changes which are desirable will depend in great part on the quality required in the finished article. For example, if a requirement of maximum heat resistance necessitates the use of an H-flow powder, pressures as high as 30,000 p.s.i. should be provided and cylinder temperatures as high as 500° F. may be required. If the requirements of heat resistance can be met by an M-flow material, then maximum pressure requirements drop to about 25,000 p.s.i. and temperature requirements to about 450° F. If an even softer grade of material, such as the S-flow, will be satisfactory, maximum pressures of 22,500 p.s.i. and maximum temperatures of 425° F. will suffice. Quite frequently it is possible to operate at lower temperatures and pressures, but it is desirable in new installations to purchase equipment which allows for some margin of safety in case more difficult jobs are encountered.

All of the commercial die-locking mechanisms, such as the direct hydraulic, the toggle or the wedge, will work quite satisfactorily. It is desirable, however, to use separate pumping or power units to actuate the die-locking mechanism and the stock cylinder. Experience seems to show that despite the use of check valves or mechanical interlocking, there is some tendency for dies to flash in machines in which both die-clamp and stock ram are actuated by the same source of power.

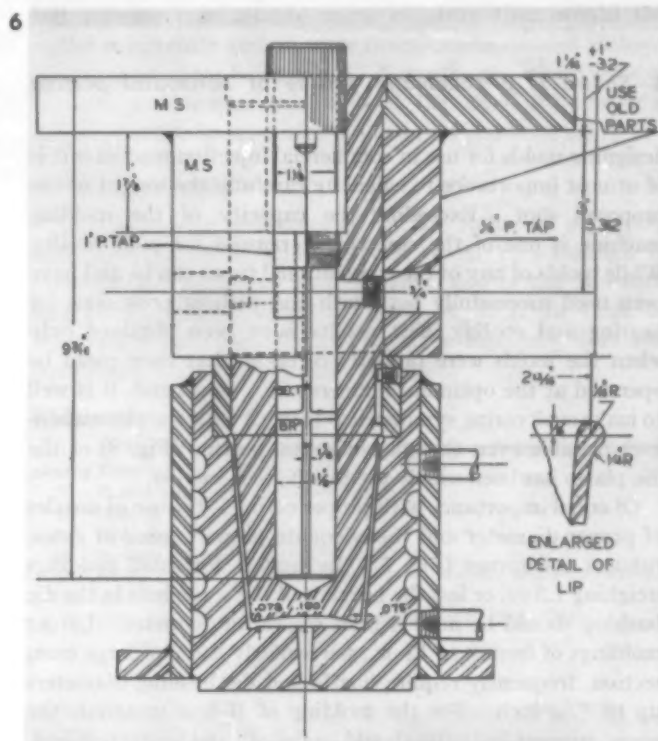
In the injection molding of the methacrylates described herein, the speed of the injection plunger is sometimes of considerable importance. This is particularly true for the difficult molding jobs in which gates are relatively small, the cross section of the finished piece relatively large, and optical or surface characteristics important. Best results are obtained when the ram speed is controlled as indicated by previous yield tests. For this reason it is desirable to use molding machines equipped with a suitable mechanism to control the speed of the plunger over a range of 0 to 160 in. per min. in a smooth stepless manner.

Any of the commercial stock heating cylinders can be and have been used satisfactorily. But the best results have been obtained in machines equipped with heating cylinders which employ zone-type heaters and in which at least two, and preferably three, control bands or zones are used. The proper balance of temperature between these zones depends primarily upon the piece which is being molded and upon the construction of the die. It may be readily determined by

making a series of moldings under several different sets of cylinder temperatures.

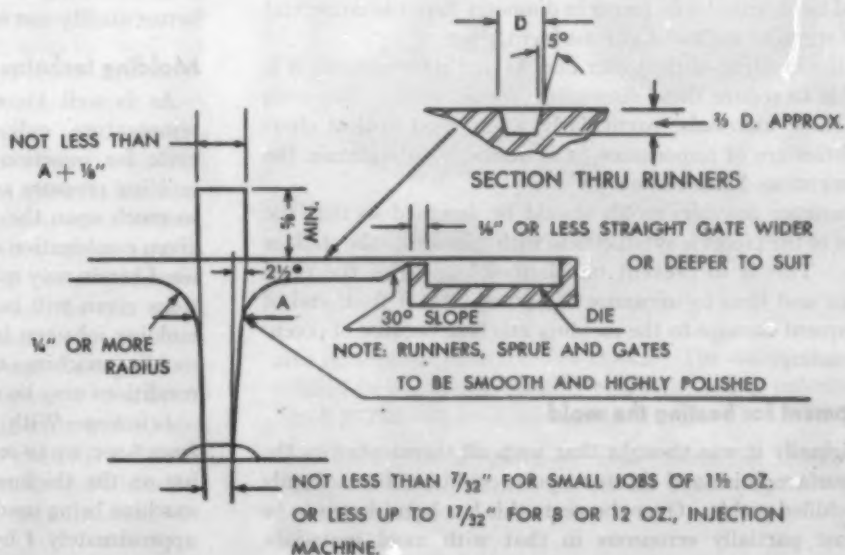
Experience has shown that most injection molding machines, regardless of the material used, will not produce first-class work at good yields if operated to the limit of their theoretically calculated or rated capacities. The rated capacity of most of these machines has been estimated on the basis of operation with a material having a specific gravity of 1.35 and at a molding pressure of 12,000 to 15,000 p.s.i. Methacrylate compounds have a specific gravity of 1.2 and are generally molded at pressures of from 17,500 to 30,000 p.s.i. Consequently, the maximum weight of shot should preferably be no more than two-thirds of the rated maximum capacity of the machine.

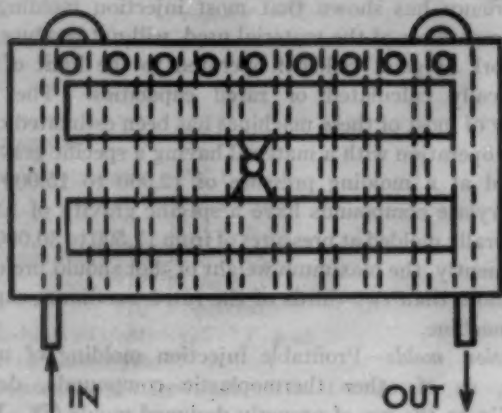
Injection molds—Profitable injection molding of methacrylate, as of other thermoplastic compounds, depends primarily on the use of properly designed molds (7). Before



7

6—Diagram of single-cavity tumbler injection mold having coring symmetrical with molded piece. 7—Detailed design suggestions for proper sprue, runner and gate proportions





8—Shown is a schematic outline of horizontal porting

designing molds for use in commercial injection machines it is of utmost importance to calculate carefully the weight of the proposed shot. Exceeding the capacity of the molding machine is one of the commonest reasons for poor results. While molds of any of the conventional types can be and have been used successfully both with and without provisions for heating and cooling, best results have been obtained only when the molds were properly cored so that they could be operated at the optimum temperature. In general, it is well to make such coring symmetrical (Fig. 6) with the piece when-ever possible even though horizontal porting (Fig. 8) of the die plates has been widely used with great success.

Of equal importance with proper coring is the use of nozzles of proper diameter and the adequate proportioning of gates, runners and sprues (Fig. 7). In general, for small moldings weighing 1.5 oz. or less the nozzle and the sprue hole in the die bushing should be no less than $\frac{7}{32}$ in. in diameter. Larger moldings of from 8 to 12 oz., particularly those of large cross section, frequently require nozzle and die bushing diameters up to $\frac{17}{32}$ inch. For the molding of H-flow materials the sprue, runners and gates should be smooth and highly polished, preferably with the polishing or tooling operations done in the direction of flow. A cold-slug well is most desirable. It should be at least $\frac{1}{4}$ in. larger in diameter than the larger end of the sprue or stalk and at least $\frac{5}{8}$ in. deep.

In the molding of the softer-flow M and S compounds it is possible to reduce these dimensions considerably. But even with these materials, particularly when good optical characteristics are of importance, it is desirable to maintain the aforementioned dimensions.

Whenever possible, molds should be designed so that the layout of the pieces is symmetrical with relation to the stalk or sprue. This is to prevent unbalanced loading of the press platens and thus to minimize the possibility of flash and of consequent damage to the molding machine because of eccentric loading.

Equipment for heating the mold

Originally it was thought that with all thermoplastics the best surface finish and shortest cycles could be obtained only with chilled molds. Over the years this has been shown to be at least partially erroneous in that with most materials, particularly the more heat-resistant compounds, better

finish, greater toughness and improved optical characteristics are obtained when the die is heated to some optimum temperature. At the same time, cycles are not excessively lengthened and, quite surprisingly, in some cases are not appreciably longer than those required with a chilled mold. Consequently, it is desirable to provide hot-water circulating systems for controlling the temperature of molds over the range from 70 to 200 ° F., and to provide low-pressure steam for carrying the temperature as high as 240° F. There are several designs for a diagram of an inexpensive water-circulating system which can be easily assembled in any molding plant. The higher temperatures will not, of course, be required for the softer grades of material for which the maximum mold temperature generally remains in the neighborhood of 160° F.

Compression equipment

Compression-molding presses—While any of the commercial compression molding presses (3), either pneumatically, hydraulically or mechanically actuated, can be and have been used successfully for the compression molding of methacrylates, best results are obtained with presses which permit the application of follow-up pressure throughout both the heating and cooling portions of the cycle. In general, hydraulically actuated presses are most widely used and have most consistently given good results. They may be of either the manual or the semi-automatic ejecting type and should be provided with suitable grids in order to prevent any excessive losses of heat from the dies to the heads and faces of the press.

Compression molds—While methacrylates have been molded in dies of practically all of the various types (4), such as the flash, the semi-positive and the full positive, it is easiest to obtain perfect results with the full positive die. Good results can be obtained with the landed or semi-positive die, but the production of perfect articles with flash dies is sometimes quite difficult.

In the design of molds for compression molding of thermoplastics it is well to remember that the cost of the molding operation will depend very much upon the efficiency of the porting. Consequently, it is of utmost importance to provide ample porting and, wherever possible, to make this porting symmetrical with the mold cavities. Thus, for the cavity for an elongated object such as a tumbler (Fig. 6), the use of coring which follows both the inside and outside contour of the cavity will permit of much more rapid heating and chilling than would be possible with straight drilled ports, and pieces of better quality can be produced on much shorter cycles.

Molding techniques

As is well known, the exact requirements as to mold temperature, cylinder temperature, molding pressure and cycle for injection molding, and as to mold temperature, molding pressure and cycle for compression molding, depend so much upon the molds and the molding equipment that a given combination of temperatures and pressures such as outlined herein may not apply in all cases. In general, the conditions given will be found perfectly satisfactory for average molding jobs run in the usual standard commercial injection molding machines or compression presses. But other molding conditions may be required in some special cases.

Injection—With methacrylate compounds, cycles ranging from 6 sec. up to several minutes have been attained, depending on the thickness of the object molded and the type of machine being used. For a thickness of $\frac{1}{4}$ in. and a molding approximately 4 by 10 in. in area, over-all molding cycles of from 45 sec. to 2 min. may be required, depending upon

the degree of freedom from strain and the dimensional accuracy which are required.

Excellent results have been obtained with the following temperatures and pressures:

Type of material	Cylinder temperature ° F.	Die temperature ° F.	Molding pressure p.s.i.
S-flow	380-420	120-130	17,500-22,500
M-flow	400-440	125-160	20,000-25,000
H-flow	440-480	180-240	20,000-30,000

Compression—In molding methacrylates, one should be careful to compensate as much as possible for the thermal shrinkage that takes place on cooling by maintaining follow-up pressure throughout the entire molding cycle. It is particularly important to maintain this pressure at the time when the die is finally closing. Consequently, it is well to close the mold under a relatively low pressure, say 300 to 500 p.s.i., and to maintain this pressure during the heating portion of the cycle. After the material in the mold is thoroughly heated, cooling water is passed through the ports of the dies. A closing pressure of from 3000 to 5000 p.s.i. is applied.

This is particularly important if flash molds are used. It is of less importance with semi-positive molds, and with full positive molds good results can be obtained with the immediate application of pressure. S-flow powders can be compression molded readily at temperatures in the range of 280 to 300° F., M-flow at temperatures of 290 to 330° F. and H-flow at temperatures of 300 to 350° F. Pressures of from 2000 to 10,000 p.s.i. are generally used. Over-all heating cycles in directly cored molds usually run from 2 to 5 min. for sections $\frac{1}{8}$ in. in thickness. In a previous issue, the curing cycles used for various thicknesses at various temperatures were outlined (6). Such curing times were satisfactory for flat test specimens. However, as experienced molders will recognize, they may be modified to the configuration of any particular mold.

General precautions

Methacrylate compounds are light in color and, in a considerable number of cases, transparent. Consequently, dirt

and other contamination can be a serious cause of rejection unless care is used in the handling and molding. Ordinary care, such as wiping the lids of drums before opening, and the application of principles of good housekeeping will pay excellent dividends. In the case of optical work it is sometimes desirable to provide filtered air to the molding room.

As is the case with other thermoplastics, the use of mixtures of different formulations will almost invariably give poor results. Hence, since all of these compounds are thermoplastic and the scrap can be remolded, it is recommended that sprues, runners, flash, etc., of each of the formulations be kept separate.

The importance of molding powders being thoroughly dry at the time of molding is well recognized in the industry. Good practice, regardless of the material used, generally requires the use of drying equipment. In some cases an infrared lamp placed over the hopper of an injection machine has proved advantageous. The new M and S formulations will tolerate considerably more moisture than would the earlier compounds and, in some cases, can be molded without special precautions being taken. Nevertheless, where work of the best possible quality is required, the use of dry powder is essential, as has been pointed out in a previous issue (6).

Acknowledgment

The invaluable assistance of W. E. Rahm in supplying molding information and sketches, of A. F. Randolph in proofreading, correcting and advising, and of the Research and Development Laboratory staffs of E. I. du Pont de Nemours & Co., Inc., Plastics Dept., in supplying data and equipment, are gratefully acknowledged.

Bibliography

- (1) M. L. Macht, W. E. Rahm and H. W. Paine, *Industrial and Engineering Chemistry* 33, 563 (May 1941).
- (2) *PLASTICS CATALOGUE*, p. 800 (1945).
- (3) *Ibid.*, p. 794 (1945).
- (4) *Ibid.*, p. 424 (1945).
- (5) *Product Engineering*, p. 415 (June 1945).
- (6) W. E. Rahm, M. L. Macht and G. M. Kuettel, *MODERN PLASTICS* 20, 86 (May 1943).
- (7) Islyn Thomas, *Ibid.* 21, 103 (June 1944); 110 (July 1944).

THIS SEALING UNIT IS TRULY AN ALL-PLASTIC application—the housing being injection molded in two parts of cellulose acetate and the tape being produced on a regenerated cellulose backing or on cellulose acetate film. Presently available in red only, the sealer will be marketed in a wide range of colors by the Cofax Corp. as soon as materials are more readily available. The three plastic elements combine to form a unit which is easy to operate and equally easy to refill. In this latter respect the sealer differs from others in the field which must be discarded once the original tape is used.

The holder for the tape contains two parts—a base which is produced in a 4-cavity mold and a snap-on cover produced in a 10-cavity mold. Both parts presented a number of molding problems. In the case of the base the difficulty centered around the proper forming of the teeth which are used to cut the tape to the desired length. As for the cap or cover, it was necessary for the piece to snap in and out without too much pressure being exerted yet hold firm when the sealer was used. For this reason, cellulose acetate was selected.

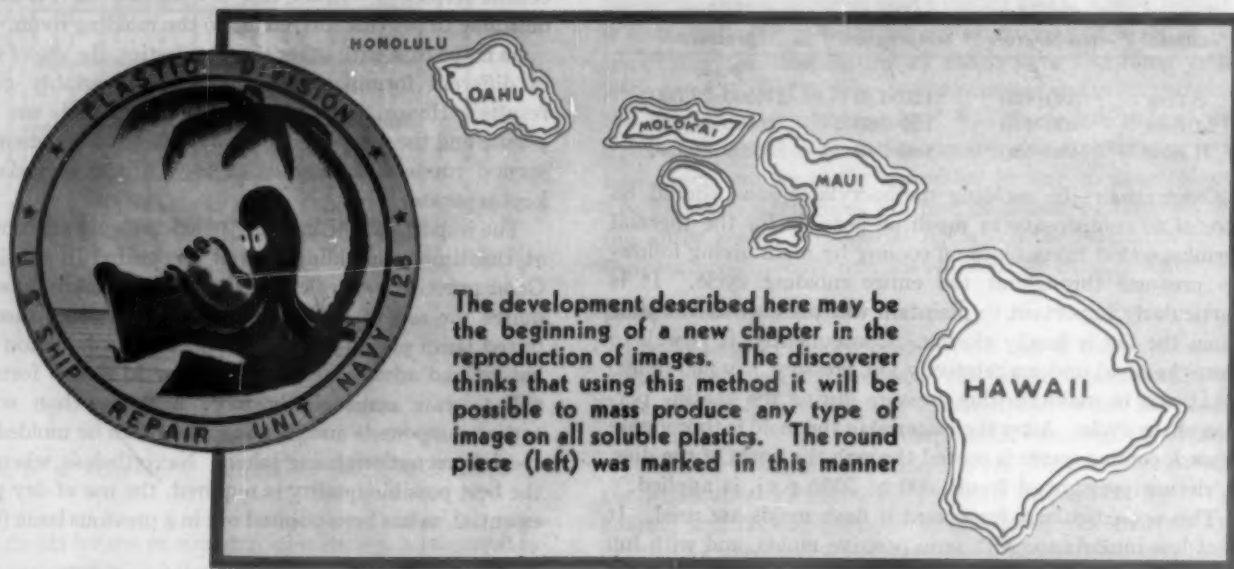
The Pax dry seal tape is available in transparent form



and in a range of attractive colors. The adhesive is applied to the plastic backing or film by a new process which is said to give it a longer life range.

Credits—Material: Lumarith and Cellophane. Holder molded by Sterling Plastics Co. for the Cofax Corp. which produces the tape

Tattooing Thermoplastics



PPRIVATE enterprise has no monopoly on ingenuity. The Navy shops at Pearl Harbor are teeming with it.

A good example—that ties in with plastics—of finding a better way to do an old job is the rapid method for photographing calibrations on instruments such as protractors, compasses, gages and plotting boards, which has been developed by Chief Electrician Edwin J. Bower and Chief Photographer's Mate John R. Nichols and their associates of the U. S. Ship Repair Unit.

The plastic used by these men is methyl methacrylate, but the method is by no means limited to this type of material. It is believed that any soluble thermoplastic would be suitable. The steps in production are as follows:

A plate of acrylic resin is placed on an ordinary centrifuge like that used by photo-engravers and washed in a methanol bath to remove the adhesive covering or other foreign matter. It is then polished with a slaked lime solution. The next step is the sensitizing of the plastic plate on the centrifuge with an ordinary emulsion in a safe light. The emulsion consists of gelatine and ammonium dichromate to which alum potassium sulfate is added for hardening.

After the plate is sensitized it is brought into contact with the master image in a vacuum frame and exposed to intense light from a typical photo-engraver's lamp for a period long enough to burn the image into the emulsion. Following the exposure, the plastic plate is placed on another centrifuge and developed with water. The portions washed out in developing form a stencil. Up to this point the process is nearly identical to that used by photo-engravers.

But when the stenciled plate is removed to yet another centrifuge it is treated with a solvent dye which dissolves its way into and is alloyed with the plastic plate. As soon as dry the entire plate is left clean with the image tattooed to any desired depth. Furthermore, the plastic may be tattooed in any color or reprocessed any number of times for the addition of different colors to obtain any variety of color or effect.

Developers of the idea believe that it will be possible to make an exact reproduction of a mahogany table top by using this method on a plastic plate. They feel that its commercial possibilities may be extended to color photography, novelties,

playing cards, transparent ceiling panels and presently undreamed of applications. It is thought that batik effects can be reproduced so that a cloth dyer may use it to get textile effects on plastic equivalent to the effect obtained on wool.

This process offers the interesting possibility of reproducing full-color color-separation directly on plastics with the additional feature of tattooing deeply into the plastic to give a greater effect of depth to the finished image.

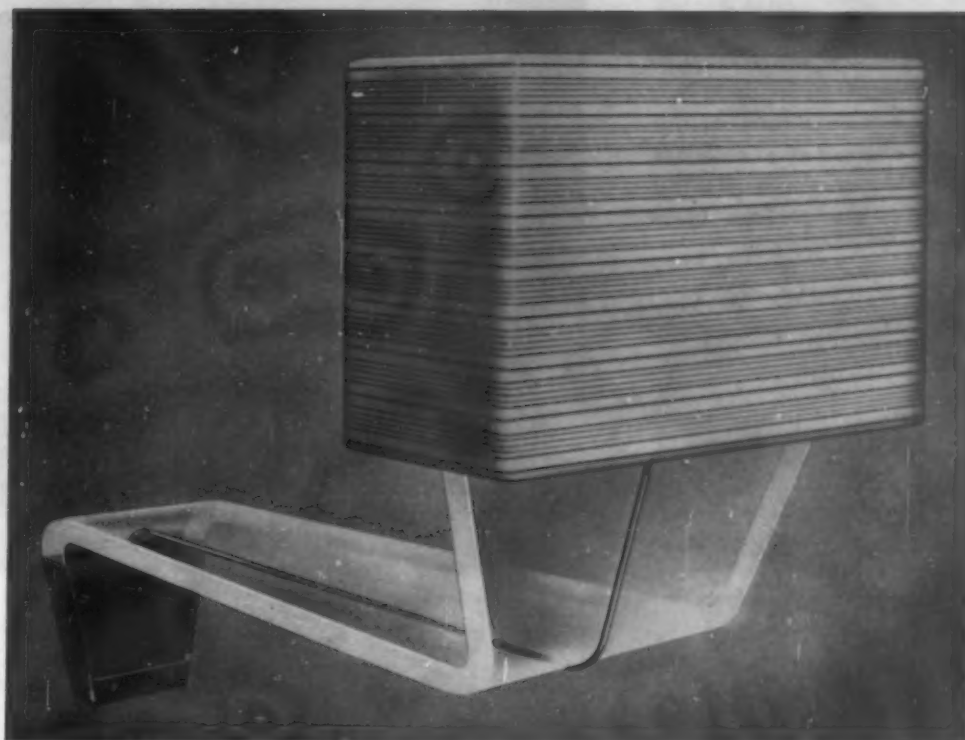
At present the process is being used exclusively to speed up production of nautical and gunnery instruments that are calibrated to an unbelievable degree of fineness and accuracy. Former processes such as that involving the insertion of a printed sheet between laminates, hand engraving or even printing are said to be much more costly, slower and less accurate than a photographic method. Furthermore, large sheets can be used and sizable quantities of small images can be reproduced simultaneously.

As is usually the custom with untried experiments, Bower and Nichols met hesitation and the doubtful Thomas attitude before they had a chance to put their theory into practice. But when the Navy needed nautical bearing splitters and none were available at the moment, the two men were given their chance. They first used a photographed image between laminates but the result was inaccurate because of parallax. During their experiments it was discovered that the plastic could be treated much in the manner of photographic film base, thus eliminating parallax and reducing the amount of film required. They proved their findings by actual production and have been calibrating all types of navigational, fire-control and engineering instruments by this method ever since.

A wide variety of jobs were quickly turned over for this method of handling. Nameplates and dial faces were made by this process. Gunnery scales formerly photographed on paper were now put out in the more durable acrylic.

The process is protected by a patent obtained by the Navy for Bower, Nichols and two of their assistants. Those having a definite interest can communicate with them by writing Edwin J. Bower, Chief Electrician, U. S. Navy or John R. Nichols, Chief Photographer's Mate, U. S. Navy in care of the Bureau of Personnel, Navy Department, Wash., D.C.

1—There's a dual role planned for plastics in this decorative wall lamp. The clear styrene arm conducts light from the bulb it supports, and the vinylidene chloride covered cord adds interest to the design. It matches the washable shade woven from multicolor strands of the same plastic



Designs for light and lightness

This is the second of a series of articles describing product development projects for which Peter Müller-Munk, industrial designer, collaborating with the Dow Chemical Co., produced a group of special designs intended to stimulate interest in new manufacturing media. The first article, "Kitchen prototype—designed for plastics," appeared in the June 1945 issue.

LIGHTING is becoming an increasingly important factor in interior design, not only in the home but in commercial and industrial installations as well. Taking advantage of improved incandescent, mercury vapor and fluorescent lamps, designers and architects are integrating demands for good visibility, balanced brightness without excessive contrasts, with decorative charm and comfort.

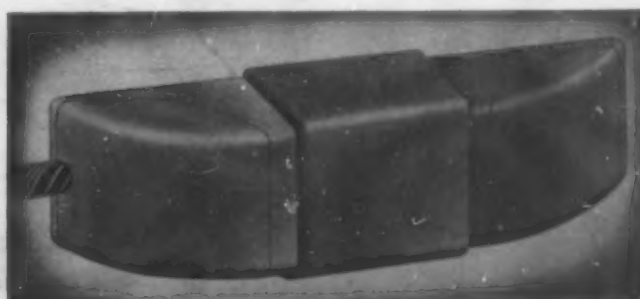
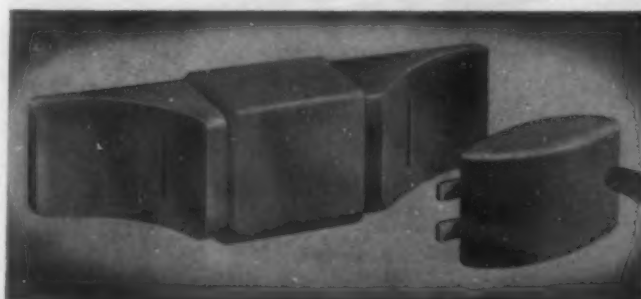
There are those among the designers who feel that custom made built-in fixtures and indirect concealed lights illuminating large areas of the walls and ceiling will be the focal points for postwar lighting design. But there will be a continuing

demand for vast quantities of standard lighting units that do not require extensive rewiring and the revamping of existing electrical systems for successful operation.

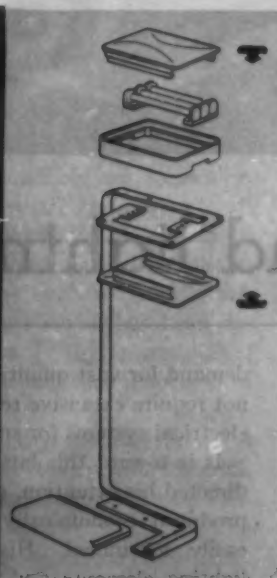
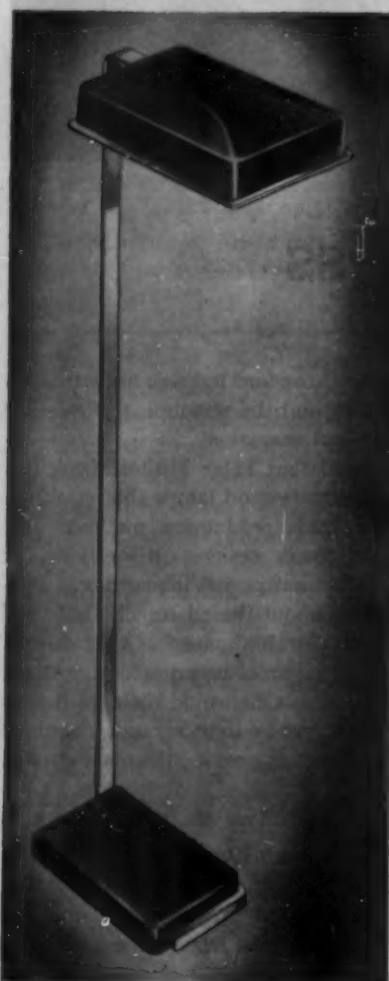
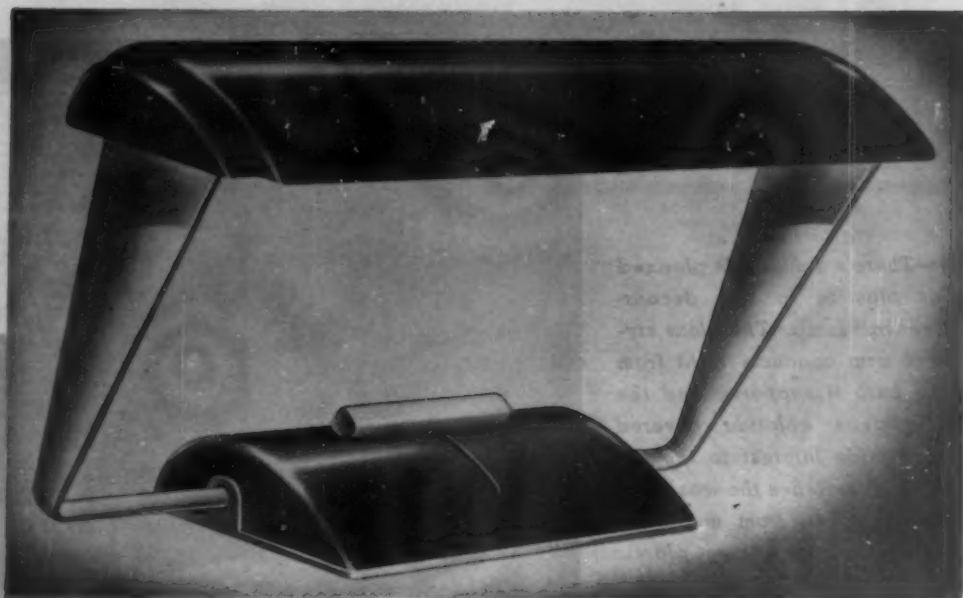
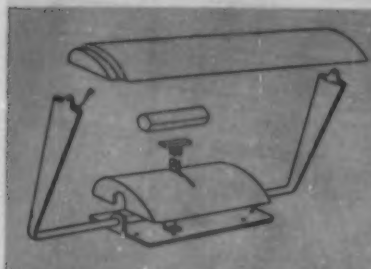
It is toward this latter field that Peter Müller-Munk has directed his attention, concentrating on lamps that could be produced economically by mass production methods and easily assembled. His proposed designs utilize efficient lighting elements and are attractive in appearance. Perhaps the most interesting fact about these lamps is that they all depend upon lightweight, durable materials that do not break easily and require a minimum of maintenance. An effort was made to select materials that would meet all design and engineering requirements, yet be light enough in weight so they could readily be adjusted to provide the maximum of glare-free illumination.

"We considered both plastics and metals for our designs," states Mr. Müller-Munk. "In each application we used whichever material offered the most in physical properties,

2 and 3—Plugs can be readily inserted in this two-outlet wall base, forming a streamlined unit that fits flush against the wall. The unit may be molded of ethyl cellulose in colors to blend with wall tones. Cord will be of woven plastic



4—Adjustable desk lamp of light-weight metal has base and shade made from colorful, easily cleaned ethyl cellulose. Assembly of the unit is detailed in the diagram below



5—Plastic shield snaps on top or bottom of lamp frame for direct or indirect light as shown above. Base will be made of the same plastic

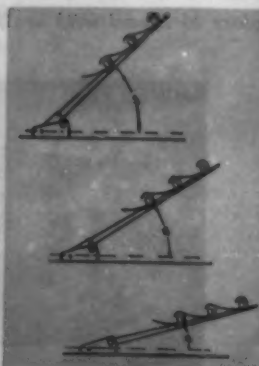
was most adaptable and reasonable in cost. We refused to kow-tow to any material, and combined plastics and metals—even adding wood, if that seemed best from the point of view of function and style. We plated the plastics to obtain reflective surfaces, and we took advantage of both smooth and embossed surfaces to ensure variations in texture.

"Plastics really play into a designer's hands. They offer him so many forms from which to choose. They are so easily fabricated into diverse shapes. In most instances the use of plastics makes considerable savings possible in assembly and finishing operations. And the light weight of these materials leads to economies in structural members and attachments."

One of the most interesting of Mr. Müller-Munk's designs is a two-outlet wall base (Figs. 2 and 3) so constructed that the plugs can easily be inserted even in the dark. The plug, designed to slide into position, is shaped to fit into the sides of the outlet to form a smooth unbroken curve that is almost flush against the wall. The plug may be molded of ethyl cellulose in pastels or deep shades to match or blend with paint or wall paper. The cord, covered with gayly colored vinylidene chloride, has a decorative value of its own.



6—White ethyl cellulose scrolls soften the glow of fluorescent tubes in this industrial wall fixture. The wooden arm pivots the unit to the angle required for best light. The wall bracket will be of molded styrene



In the wall lamp shown in Fig. 1, the light transmission properties of transparent polystyrene are utilized to carry light around a heavy bent sheet. The lamp fits into a molded polystyrene supporting bracket. Its shade is woven of multicolor strands of extruded vinylidene chloride. No attempt is made to conceal the light cord, covered with the same material as the shade.

Although there is comparatively little plastic material specified for the desk lamp (Fig. 4) and the floor stand (Fig. 5), in the few places where it is employed its use was carefully determined on the basis of color values, lightness and ease of forming. Structural parts are all of magnesium, but shades and base coverings are deep drawn from ethyl cellulose sheet.

The metal arms of the desk lamp are adjustable, pivoting down to any desired angle for better visibility. The floor lamp doubles as a direct or indirect luminaire; it is only necessary to snap the plastic shade into position either above or beneath the frame which supports the fluorescent tubes.

The drafting lamp (Fig. 7) employs the same material as the desk lamp for its long three-sided shade which is welded at the corners. A swivel-type base is used so that a wide arc of light can be thrown over an entire drafting table.

In the three-way wall fixture (Fig. 6), designed for commercial or industrial use, white opaque sheets of ethyl cellulose are formed into a modified S-shape with the top and bottom curves serving as shields for fluorescent tubes. A swivel arm of light wood supports the light tubes and shade, and is an excellent foil for the plastic in texture and color.

The all-through color and formability of plastics are of special advantage in this design where both durability and economy are paramount considerations. "If we made this shade of metal," states Mr. Müller-Munk, "we would have to do a lot of spraying, beading and finishing. And then we would need to spray the metal to offset its cold appearance."

The circular ceiling fixture (Fig. 8) combines an ethyl cellulose mounting plate with a deep-drawn polystyrene bowl. The latter has a metal plated outer surface to reflect light up toward the mounting plate which reflects and diffuses.

The field of lighting offers so many opportunities for soundly

7—A boon to draftsmen, this three-sided lamp is adjustable to several positions as illustrated in diagram. The shade is formed from ethyl cellulose, which is welded at the corners, providing glare-free illumination

engineered and well-designed plastics applications, both in conjunction with other materials and as a separate medium, that these eight designs can only point the way. Additional ideas suggested by Mr. Müller-Munk include: use of luminous pigments in wall switches; two-tone molding for flashlights; traffic lights with plastic signals that differ not only in color but in shape for easy recognition.

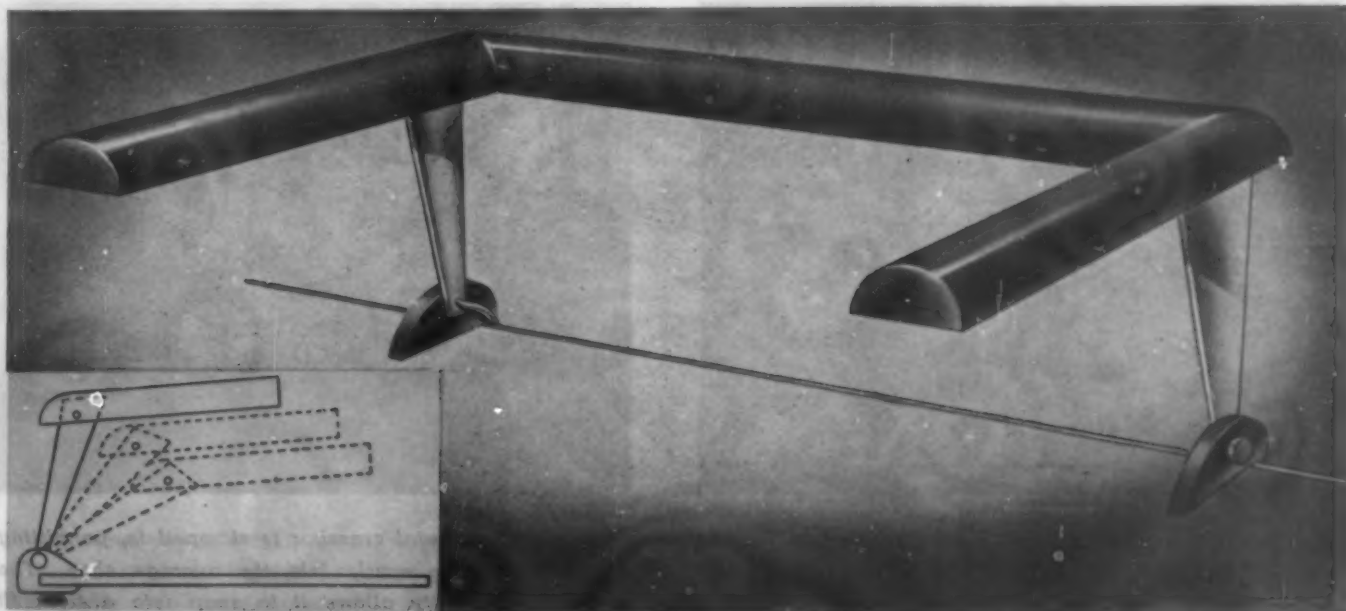
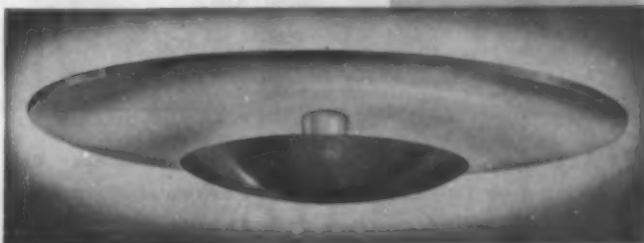
There's a vast field to be explored and a public, conscious of lighting problems, that warrants serious consideration. The war workers who have experienced brilliant illumination in factories, the homemaker who looks for aesthetic effects as well as eye-comfort, the business man who recognizes the inefficiency produced by poor lighting, all will welcome the best lighting product the illuminating engineer, designer and architect can create—and they will look to them to find the right material to do the job.

Credits—Materials: Styron for wall lamp base and bracket, industrial fixture and wall bracket, ceiling fixture bowl

Ethocel for wall plug, ceiling fixture mounting plate, base and shades of desk, drafting and floor lamps

Saran for wall lamp shade and electric cord coverings

8—Lightweight, easily assembled ceiling luminaire has circular ethyl cellulose mounting plate combined with deep drawn styrene bowl, metal plated to reflect light upward. Construction is shown above





ALL PHOTOS, COURTESY SHOE FORM CO.

1—The preform, already stamped for size, is wrapped around a wooden model held on a rod connected to a movable spindle. It is then shaped against a steam pillow



2—An operator aids the mechanical process with pliers, and as the material shrinks, draws it more firmly to the mold. Heat, pressure and moisture mold the form



3—Then, the molded shape is trimmed with a closely guarded patented machine. Motion of the rotary blade helps feed the material as water drops on it to prevent fire

More hand labor ... not less

PLASTIC materials seem to have reached that advanced stage of development where, in some instances, methods of processing that require considerable hand labor turn out to be the best. Here are two ingenious products, among the leaders in their respective fields, that owe a great deal of their success to just such molding and fabricating methods. In the case of the cellulose nitrate shoe display forms, the hand labor is instrumental in wrapping the plastic sheets around wooden models. In the cellulose acetate utility boxes it is called upon for the assembly of the ribbing that forms the various compartments.

The results in both instances are the same—increased versatility. Were metal molds to be used in the production of the shoe display forms, instead of inexpensive easily formed wooden models, the increased production costs would, without doubt, force the molder to reduce the number of available sizes or increase the selling price. Similarly, were compartments to be molded into the utility boxes rather than to be put in by hand, the user would need to specify a greater quantity of boxes to justify the cost of molding a box divided so as to meet his particular needs.

Shoe display forms

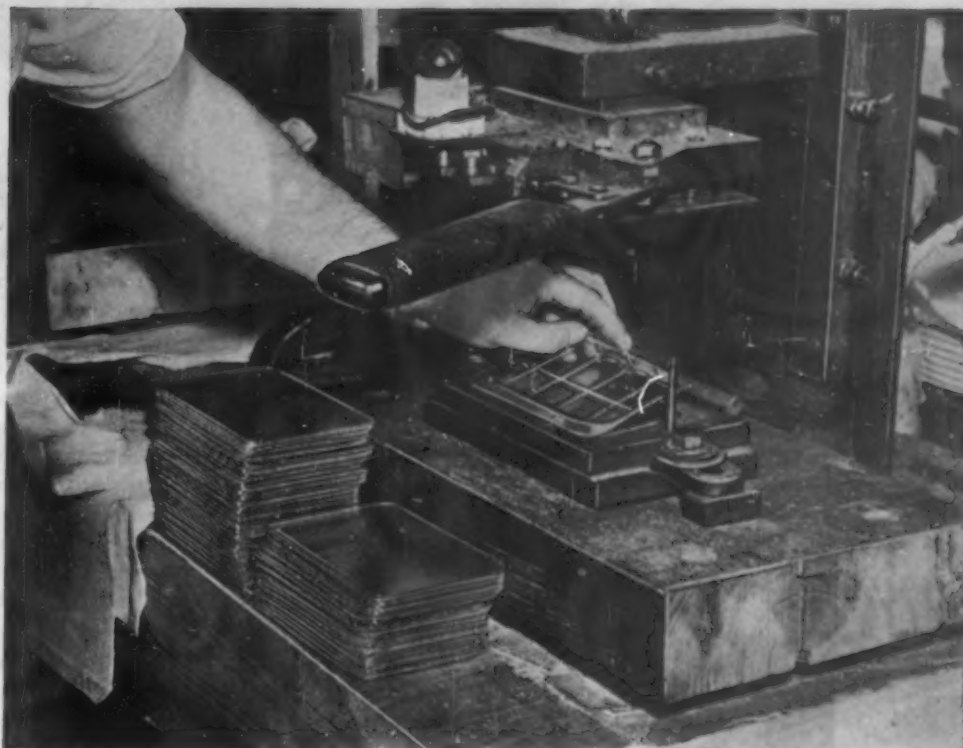
The first step in the forming of the cellulose nitrate shoe forms, which display men have accepted so readily in preference to heavy plaster-of-Paris forms that are prone to chip and crack, is the stamping of the preform. Sheets of the desired size are then drawn around the wooden model (available in a wide range of sizes and shapes to conform to an endless number of lasts) which is held on a rod connected to a movable spindle actuated by a foot lever. The plastic sheet assumes the shape of the model, which acts as the male form, as it is pushed into a steam pillow, or female mold. The operator



4—A patented metal crossbar is stamped in, permitting the form to slide easily into the average shoe. The material's elasticity allows it to snap into a tight fit

6—In forming the boxes, flat sheets are cut so as to eliminate unnecessary waste, with only sufficient trim to permit drawing. The material, preheated on a steam table, is then placed in a swaging machine where pressure is applied for from $\frac{1}{4}$ to $\frac{1}{2}$ minute

7—Trimmed after molding, the top and bottom sections are hinged together and inserts are brushed in with a solvent



6

aids the mechanical process with his pliers, drawing the material more firmly around the wooden model as it shrinks.

The molding operation completed, the shoe form is dropped into cool water to hasten the hardening process. Trimming follows during which a section of the cellulose nitrate is cut away from the bottom of the sole to leave room for the attachment of a metal crossbar. The flexibility of this bar makes it possible for the display form to slide into the average shoe, yet maintain a tight fit once it is in place. Finally the plastic form, which is either sprayed with pearl, beige or pink paint or left the color of the material, is finished with hand-painted toe nails.

Transparent utility boxes

Transparent utility boxes are being used on an ever-increasing scale for carrying and storing small parts and for



5—The finished shape, which is sprayed in pearl, beige or pink, or left in the pigmented color of the material, then receives any necessary final details by hand



packaging various objects—from coffee beans to printer's type. They are designed with patented ribbed channel construction which extends across the entire surface of the box and its lid, adding to the rigidity of the container. Because of this construction, when the partitions are welded in the body of the transparent containers with an activating agent and the lid closed, there is no danger of the dividing walls slipping out of place, thus allowing the parts in the various compartments to become scattered and defeating the immediate purpose of the box.

In order to eliminate unnecessary waste of the plastic stock, the flat sheets of cellulose acetate are cut with due allowance for the drawing operation. Preheated on a steam table, the material is then placed in a swaging press where it is subjected to pressure for from $\frac{1}{4}$ to $\frac{1}{2}$ minute. After molding, the top and bottom sections are trimmed, then hinged together. The final operation involves the hand insertion of the transparent dividing walls.

Credits—Material: Shoe form, Amerith, Celluloid and Pyralin; Utility box, Lumarith and Pyra-shell. Molded and fabricated by Shoe Form Co.



THE HUSHATONE, A SMALL EXTENSION speaker for individual listening is proving a real boon to hundreds of men in our armed forces who are confined to hospitals throughout the country. Molded of tough high impact phenolic, the housing for this unit consists of a back or case, and a grid to protect the plastic diaphragm. A vinyl resin bayonet plug, shaped to fit flush with the rim of the outer case, and a vinyl resin cord complete the assembly.

Because of the small size of the housing— $4\frac{3}{16}$ in. in diameter and $1\frac{1}{16}$ in. thick—the Hushatone fits under a pillow without making a lump. No regulator is needed, the volume being changed by shifting the location of the unit under the pillow. The entire unit, which is covered by patents, is without moving parts and is hermetically sealed. It may be cleansed in disinfectants heated to temperatures under 120° F.

The Brush Development Co. believes that in the future the speaker will be used in railway coaches and in the home, where one person may wish to hear a program without disturbing others.

Credits—Material—Bakelite and Vinylite. Housing molded by Werner Mfg. Co., plug molded by Lens Wire, Inc., for Brush Development Co.

PLASTICS

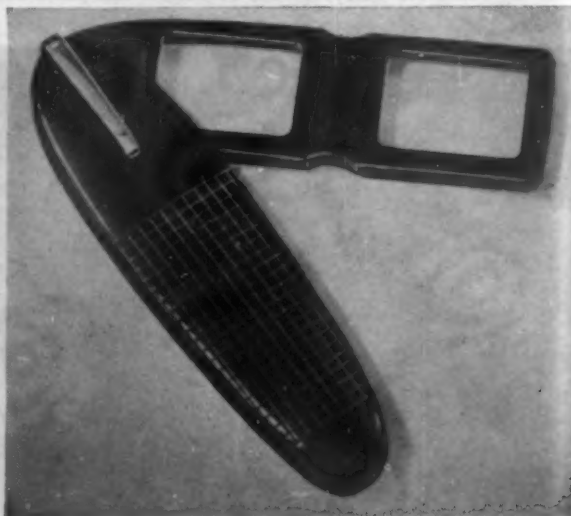
THROUGH THE USE OF A BINOCULAR MAGNIFIER now on the market, jewelers, inspectors, stamp collectors and others whose profession or hobbies require close work with a magnifying glass may find relief for their eyes. Because it has two lenses instead of one, this eye aid, which is known as the Twin Reader, does away with squinting and the eye-strain which often results from attempts to examine an object through a single magnifying lens. The dual lenses of the instrument present a sharper image and a larger field of vision, and give the user a sense of three-dimensional space.

Handy to manipulate, the reader folds away in its own case—the size of the average spectacle case—which serves as the handle when the instrument is in use. Because of its compactness and light weight (less than $1\frac{1}{2}$ oz.) this magnifier can be tucked into a handbag or pocket and used to read price tags or examine fabrics. The manufacturer stresses the point that the instrument is not intended as a substitute for eyeglasses but may be used by persons wearing glasses.

Entirely plastic except for the lenses, pocket clip and one small screw, the magnifier is injection molded of black cellulose acetate butyrate. There are six plastic parts including two tiny disks which cover the

heads of the assembly. A lattice-like design on the handle or case provides a firm grip.

Credits—Material: Tenite II. Molded by Sterling Plastics Co. for Edroy Products Co. Designed by Dohner & Lippincott



MOLDED PHENOLIC VIALS ARE NOW BEING used by the armed forces as containers for salt tablets with which a soldier can combat the effects of heat exhaustion so often encountered in the war in the Pacific. Each of these tiny containers holds four of the salt tablets, and they will be packed in both C and K ration kits to make them available for front line troops.

Manufactured by the millions, the vials are approxi-



mately $1\frac{1}{16}$ in. high, complete with caps, and just over $\frac{1}{8}$ in. in diameter. In fact, it is their small size that has made possible their manufacture on a large scale using automatic molding machines.

Before the molding of these bottles could be undertaken it was necessary to find a plastic material which afforded protection against wide variations of temperature and relative humidity. Twelve different materials were tested, five of which were approved for use in these small but important vials. These tests extended over a period of three and a half months and included storage tests run at 100° F. and 90 percent relative humidity; 100° F., 40 percent relative humidity.

The postwar applications for bottles of this type seem almost endless. They could be carried over directly as salt tablet containers for factory workers, or they might find an important use as medicine containers, or pill boxes. And there are many other fields, somewhat removed from their present use where they could prove useful when material and supplies are freed from the demands of the military.

Credits—Molded by Owens-Illinois Glass Co. Packed by AZO Products Co., Inc., and Rayner Pharmacal Co. for U. S. Government

PRODUCTS*

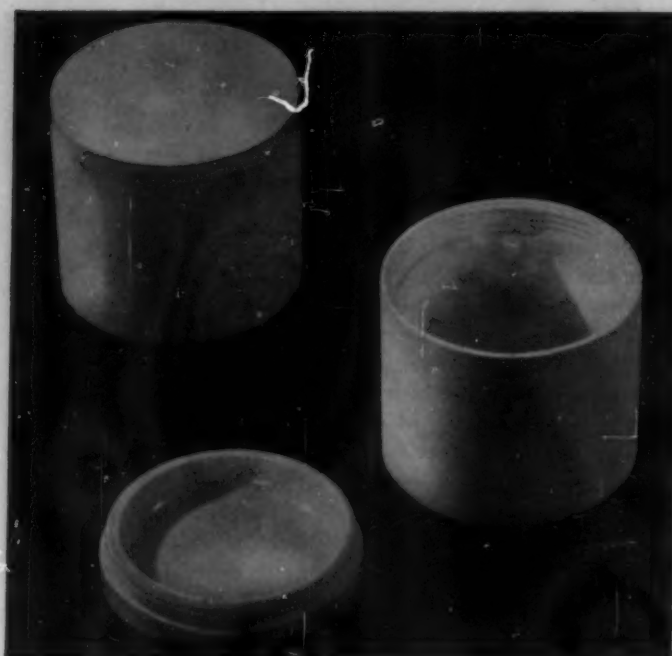
A MOTH CONTROL UNIT WITH AN ALL-plastic body, which creates heavy gas and sprays it on articles of clothing, fabrics and furniture, has been developed by the Air-Way Electric Appliance Corp. for use with its products. The spray is so designed that when it is attached to a vacuum cleaner hose the stream of air from the cleaner whirls the liquid moth control that fills the glass jar and converts it into a gas approximately five times heavier than air.

There were two principal reasons for the selection of a phenolic material for the body and cellulose acetate for the side cover of this spray. They were weight and visibility. The transparent cover parts are injection molded in a two-cavity mold having an automatic core arrangement which forms the side hole in the piece. The black phenolic bodies are transfer molded in a two-cavity semi-automatic mold. In this body mold, the long core pin has a tangent engagement with the core plug that forms the inside diameter, and these pins move horizontally through hydraulic cylinders.

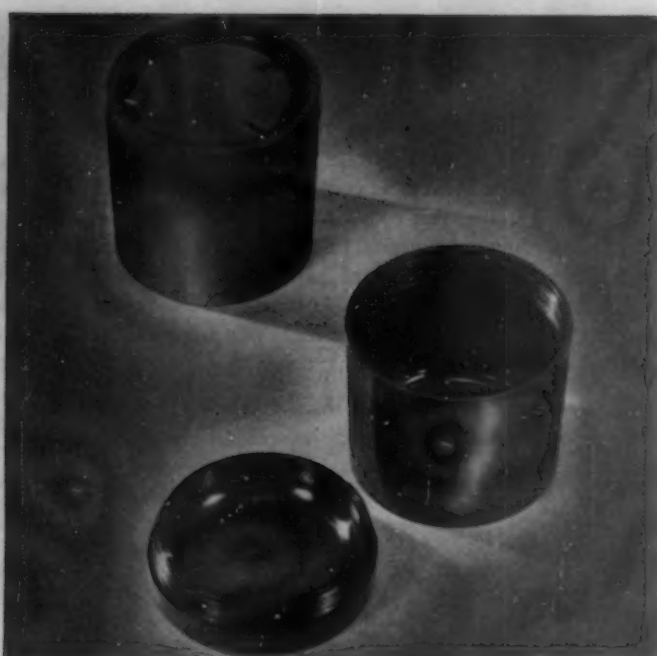
Credits—Material: Durite and Arcolite. Molded by Consolidated Molded Products Corp. for Air-Way Electric Appliance Corp.

* Reg. U. S. Patent Office.





1



2

1—The lid, or larger half, of the white cast phenolic phosphorus bomb cup is $2\frac{5}{8}$ in. high and $2\frac{5}{8}$ in. in diameter whereas the base is only $\frac{1}{2}$ in. high. 2—The black bomb cups are molded of a phenolic material which has some asbestos content. Both the lids and the bases are produced in 6-cavity molds

Fire bombs over Japan

Both cast and molded phenolic materials have played an important role in the M-74 incendiary bomb. They comprise the phosphorus cups which break as they land and pour forth the phosphorus which immediately bursts into flames

FIRE—it characterized our onslaught of the Japanese archipelago. One after another the cities of Japan went up in flames under the bombardment of our airmen. One of the agents for these fires was a bomb which holds a plastic cup filled with a small quantity of white phosphorus, a few pounds of pyrotechnic gel and a dome-shaped ejection diaphragm.

This M-74 bomb, developed under the supervision of the Chemical Warfare Service, Technical Command, Edgewood Arsenal, and Brig. Gen. Wm. Kabrich, Chief of the Technical Command, is an outgrowth of the incendiaries which were first used in this war by the Germans and later copied by the British. The early models developed in this country had a cloth tail with flowing streamers and a side fuze. There were two principal disadvantages to this incendiary. The streamers often caught in trees and they reduced the terminal velocity to a point where the bombs often failed to penetrate German buildings—the original targets of our incendiary raids. More important, perhaps, these early bombs had to strike in a set way in order to explode.

Both these objections have been overcome in the new M-74 incendiary. Outwardly this 10-lb. bomb resembles a 19-in. length of hexagonal pipe. One end is closed by a collapsible metal tail, which springs open when the bomb is released from the plane—more or less holding the bomb to its course. At the nose is a sensitive fuze which ignites the incendiary upon impact, regardless of the angle at which it strikes. Blown open by a burster charge, the diaphragm inside the bomb

works like a piston to expell itself, the plastic cup containing phosphorus, the pyrotechnic gel and the collapsible tail. Gobs of the lava fly for 25 yd., cling to the surfaces they strike and burn.

And the plastic cup, breaking as it lands, pours forth phosphorus which bursts into flames immediately upon exposure to the air. So intense is the heat thus engendered and so dense the smoke that fire fighters are seriously hampered in their efforts to put out the flames touched off both by the burning gel and the phosphorus.

The first of these bombs to use plastic cups were dropped by B-29's on Tokyo in the latter part of May of this year. They are salvoed in clusters of 38, and one B-29 can carry 76 of the clusters. The clusters are dropped four at a time from the bomb bays in the nose, the main body and the after part of the fuselage. The Army describes these clusters in terms of size rather than weight. Thus, the 38-bomb cluster is referred to as a 500-lb. cluster because it is the size of a 500-lb. demolition bomb.

Cast phenolic cups

Two operating conditions governed the selection of the material for the phosphorus cup carried by each of these M-74 incendiaries. The cup must hold its load of phosphorus, without leaking, until the bombs are salvoed upon the enemy; and it must break open instantly upon contact with the enemy target.

The first plastic cups to go into production were of cast



FIGS. 2 THROUGH 7, COURTESY UNIVERSAL PLASTICS CORP.

3—The phenolic material used in the molded cup is made into preforms to insure accurate control over the weight of the charge. Preheating of the general-purpose phenolic is employed to insure better conditioning

phenolic.¹ As a result of tests run off in the spring and summer of 1943, a phenolic resin was developed which seals the cups. After a charge of phosphorus is loaded under water in the larger half of the cup, the surface of the phosphorus is covered with a sealing compound, the threads coated with the sealing resin and the two halves of the molded cup are screwed together.

Draw cast, the cup consists of a lid $2\frac{5}{8}$ in. high and $2\frac{5}{8}$ in. in diameter, and a base $\frac{1}{2}$ in. high and $2\frac{5}{8}$ in. in diameter. The walls of the piece are $\frac{1}{8}$ in. thick, and the specifications give a tolerance of $\frac{1}{64}$ in. on all dimensions.

The extra cured phenolic castings, two to a cup, are supplied to a number of fabricators for threading—practically the only finishing operation that is necessary on these parts. As it is done in the plant of one fabricator, the finishing of the base requires two operations, that of the lid, three operations. The threading of both the lid and the base was considerably simplified by this fabricator through the use of a special attachment—a thread mill cutter with a carbide tip—on a regular drill press and by adapting this unit to operation by compressed air. Air under pressure activates an air chuck which opens and closes the vise that holds the piece in place on the drill press. This action makes it possible for one operator to handle two machines at a time.

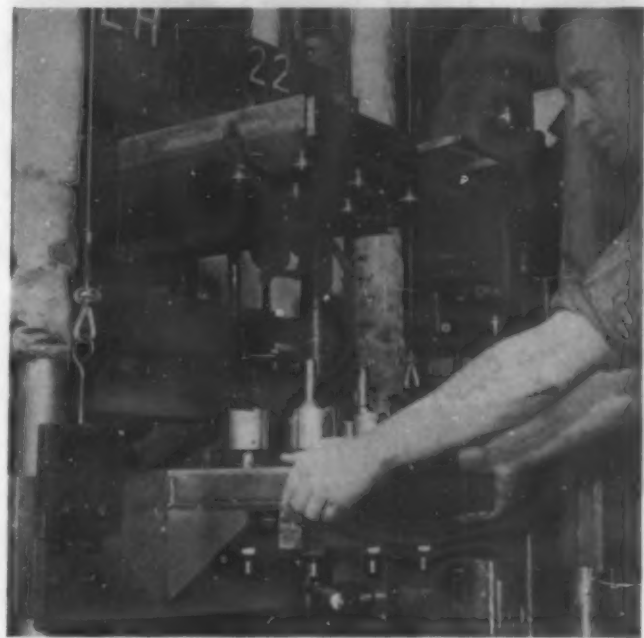
In finishing the cast phenolic base of the phosphorus cup the first operation is to put on the shoulder with a speed lathe. Then the piece is threaded on a regular drill press with special thread milling cutter as was described in the preceding paragraph. In the case of the lid, the shoulder is counterbored and then beveled to facilitate the starting of the thread. The threading operation for the part is the same as that which is used for the base.

These cast phenolic cups are inspected twice—once immediately after they are cast, and once after fabrication. The testing device is a box with a light inside and a hole in the side

¹ Material on cast phenolic cup supplied by John H. Keeley, Catalin Corp., and Claud A. Letarte of Plastic Turning Co.



4—To facilitate the removal of the parts from the press, the molds for lids and bases are constructed so that the parts adhere to the top force plug. An automatic unscrewing device then removes them



5—The molding of the bases, or small half, of these bomb cups is exactly like that for the lids

whose circumference matches that of the cup. When the halves of the cup are fitted in this hole, light shows through the piece, revealing streaks of lead, cracks, dirt, small holes or similar defects.

Molded phenolic cups

Recently, a long list of molders have gone into production on black phenolic cups for the M-74 incendiary bombs. The following description of the molding and finishing of these cups, while dealing with the production in only one plant,



6—A conveyor belt carries the molded parts from one inspection table to the next. The belt is divided in the middle—the bases on one side and the lids on the other. Both the domes and threads are very carefully gaged



7—After inspection, the lids and bases are assembled, and their outside diameters checked in a chamber gage

points up the general production methods followed in the molding of these cups.²

The material, designated as a general purpose phenolic with some asbestos content, is made into preforms to insure accurate control over the weight of the charge. It was also felt that preheating of preforms would insure better conditioning of the plastic. The molds are run in 100-ton presses under a pressure of 4000 p.s.i. at temperatures ranging from 300 to 330° F. Figure 3 shows an operator in the process of charging a 6-cavity lid mold. For this large half of the phosphorus cup the approximate cycle is 3 minutes.

The molds for both the lid and the base of this cup are constructed in such a way that the molded part always adheres to the top force plug. The fact that the threaded portion

of the mold is located in the force plug is evidence of this fact (Fig. 4). To remove the molded parts from the mold, an automatic unscrewing device was worked out which operates on a counter-balance weight principle. At the completion of the molding operation, after the press has opened, the top plate is moved out of the molding machine on tracks. When the top force is directly over the unscrewing fixture, this fixture is raised to engage the lugs molded in the bottom of the plastic part. The disassembling device, which is operated by a motor connected with a series of sprockets and chains, unscrews all the molded parts at once—six lids in the case of the mold shown in Fig. 4. The bases of these phosphorus cups are molded and unscrewed in a like manner (Fig. 5).

The bases and lids of these cups are sent directly from the press room to the inspection department where they are subjected to several gaging tests. The conveyor belt (Fig. 6) that carries the parts from one position to the next is divided in the center. The bases are on one side, the lids on the other. The first operation is a visual inspection for cracks, blisters and unfilled sections; the second is the gaging of the dome. The specifications for the dome of both halves of the phosphorus cup are extremely rigid, and those parts that have too high a dome are rejected at this point. The good parts pass along to a third inspection table where the threads are gaged. Once again the molded pieces which do not meet the specifications are discarded. At the end of the conveyor the good bases and lids are mated. Then the assembled bomb cup is passed through a chamber gage which removes the flash and checks the outside diameter to insure its falling within the limits set in the specifications.

Since the bomb cup must break if it is to function successfully, parts are frequently picked from a production run and checked for fragability.

As the intensity of our air attacks upon Japan increase, we may expect to hear more and more about the devastation wrought by the M-74 incendiary bomb. And playing an important role in this destruction are thousands of plastic cups which quietly bear their load of phosphorus to the target area, then break to release a destructive flow of fire.

Credits—Cast phenolic cup, Catalin. Phenolic cup molded of Bakelite, Resinox and Durite by Universal Plastics Corp.

² Material on molded phenolic cup supplied by S. Leon Kaye of Universal Plastics Corp.

Postforming and its application

by BRUCE NASH*

LAMINATED phenolic plastics are not new to industry. Current manufacturing practice, however, seems to anticipate the use of more and more of these materials in the forming of shaped and drawn parts in relatively inexpensive molds. Development work in this field has indicated that with some modifications the standard resins now employed can be more readily softened under the application of heat, usually around 300° F. The properties of such laminates are comparable with NEMA Grade C materials.

In the manufacture of phenolic resins, the resin becomes increasingly viscose as the "set" state is approached. It was noted that in this set state the new modified resins exhibited pliability characteristics at elevated temperatures. Thus, normally cured laminates may be reshaped with the application of heat. Typical time-viscosity curves for several phenolic laminating resins are shown in Fig. 1.

Types of molds

Molds used in the forming of phenolic laminates are designed for bench, semi-automatic or automatic operation. For small orders, it is common practice to make a mold with only a male member. With this setup, some means must be provided for wrapping the material around the mold; canvas and cloth are often employed for this job. Manually oper-

ated bench molds are much used for small and intermediary production. But when large production is involved, the more common practice is to use molds of the semi-automatic and automatic type which have greater durability.

Bench molds are hand operated and pressure is applied with the aid of clamps, locks, hand screws or levers. Semi-automatic molds, on the other hand, are mounted in hand arbor presses or vises; Fig. 2 shows such a mold and the part it forms. Parts of relatively thin sections, simple shapes, parts with small over-all dimensions and small deep-drawn shapes are best formed in molds designed for one of these two types of operation.

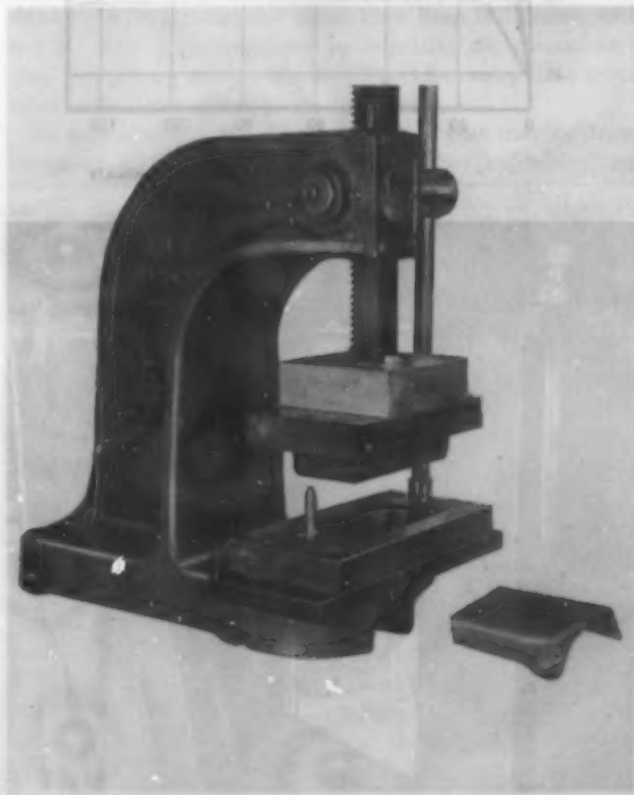
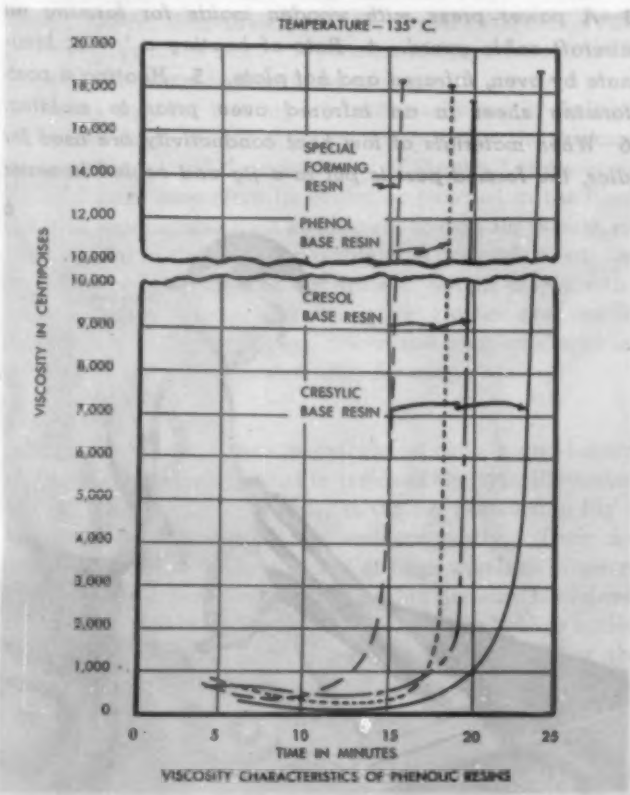
Molds intended for automatic operation may be mounted in mechanically, hydraulically or pneumatically operated presses. Figure 3 illustrates a mold designed for power press use; the over-all dimensions of the part being formed are 33 by 20 inches. The mold is built so that contact is first made with the blank which rests on a spring-activated floating section. As the blank and the floating section travel downward, the sides and flanges of the part are formed. When the bottom section has closed, ribs emerge from the top section to form the stiffening ribs. In general, parts to be formed in a power press operation are those with relatively large over-all dimensions, deep draws and intricate shapes.

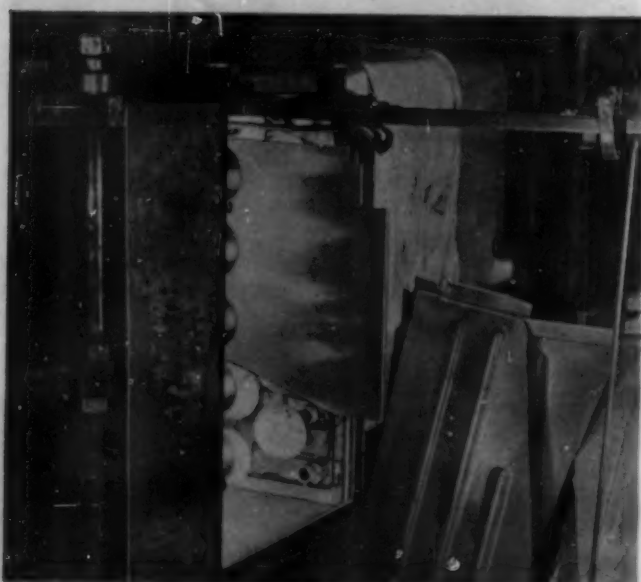
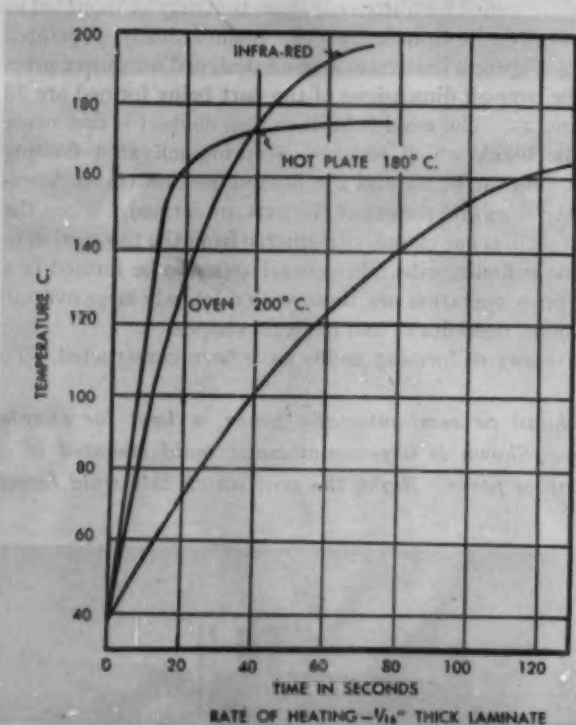
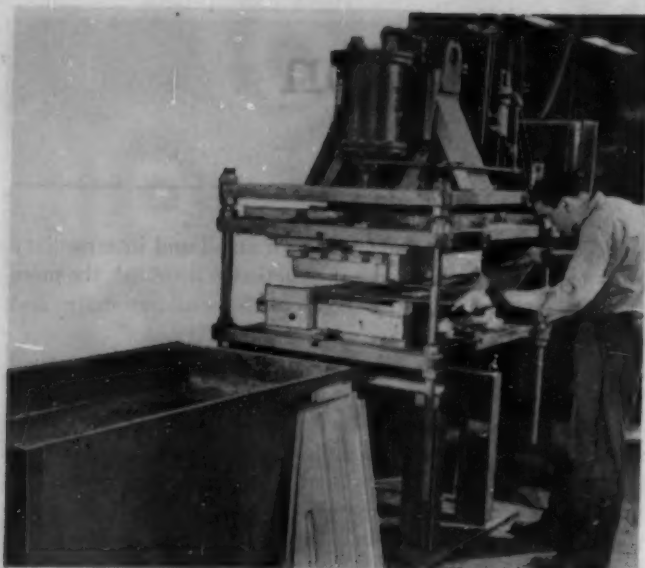
A diversity of forming molds have been constructed. To

1—Time-viscosity curves for four phenolic laminating resins. At the higher temperatures employed, the resin reaches a workable state in a shorter period of time

2—A hand or semi-automatic press is best for simple shapes. Shown is a semi-automatic mold mounted in a hand arbor press. Right, the part which this mold forms

ALL PHOTOS AND DRAWINGS, COURTESY WESTINGHOUSE ELECTRIC CORP.





insure the best use of each tool, it is desirable to evaluate fully all factors involved in the design of the part and its application before any work is started. Some of the more important factors which affect mold design are: 1) shape and application of the part; 2) dimensions such as the thickness, radii, over-all height; 3) number and position of holes, bosses, etc., in the finished part; 4) tolerances; 5) quantity to be produced; and 6) die material to be used.

Die material

A number of satisfactory materials are available for use in the construction of forming molds. Hardwood is one of the most common. It is cheap, easily worked and will stand a fair number of pressings. However, the repeated heating and cooling to which it is subjected may cause warping and cracking. For this reason wood molds are not generally suited for large-scale production unless reinforced.

Molds made of laminated plastic materials have proved very satisfactory. They are relatively cheap, easily worked and are still in operation; no failures have yet been reported. Such molds are well suited for both large- and small-scale production. An additional advantage is the higher heat conductivity of laminated plastics which means that molds will cool the part faster and reduce the pressing time.

Metal molds are extremely durable and can be water cooled, thus reducing the operating time. However, because of their high cost they are seldom used unless for large quantities. Cast plastics, masonite and concrete are also satisfactory.

Die materials having some resilience or "give" are the type best suited for hot forming since an equalization of pressure is accomplished without high accuracy in die surfaces. In general, die clearances should be 10 to 15 percent in excess of the thickness of the material to be formed.

General forming procedures

In hot forming phenolic laminated plastics it is desirable to heat the flat sheets to the optimum forming temperature as

3—A power press with wooden molds for forming an aircraft cable guard. 4—Rate of heating a $\frac{1}{16}$ -in. laminate by oven, infrared and hot plate. 5—Heating a post-forming sheet in an infrared oven prior to molding. 6—When materials of low heat conductivity are used for dies, the formed part is put in a jig and cooled in water



rapidly as possible. Prolonged heating will tend to embrittle the resin. Various sources of heat have been used—hot plates, high-frequency electrical current, infrared lamps, hot air ovens and hot liquid baths. Rate of heating curves for some of these heat sources appear in Fig. 4. For best formability, the material should be heated to 300 to 350° F. (145 to 180° C.). The maximum temperature allowable is determined by noting the blistering point of the material.

In the forming of the cable guard (Fig. 3) the blank is heated in an infrared oven for approximately 30 sec. since the blister time of the material is around 35 seconds. Care must be taken not to overheat or underheat the piece as the former will cause blistering and the latter will reduce the formability so that cracking will result at the sharp bends. The heated blank is rapidly positioned in the mold which is then closed. Stops are mounted on the sides of the mold to insure correct positioning of the blank. There is a lapse of from 6 to 10 sec. between the time the material is removed from the heating oven and the time the mold is in the closed position. If more than 15 sec. elapse, the material will lose so much flexibility that cracking will likely result.

Forming dies that have no cooling device build up in heat after a few pressings. Under these conditions, if the shaped part were to be "fixed" into its final form while in the mold, considerable cooling time would be required, and production slowed down accordingly. Wood dies are particularly bad in this respect for once the dies build up in heat they retain it for a long time. Accordingly, when wood and other materials of low heat conductivity are used, it is common practice to provide jigs and fixtures for holding the formed part to the desired shape after it has been removed from the forming die. Thus fixed, the part may be immersed in cold water or air cooled. Figure 6 shows the cooling fixtures used to hold the cable guard in shape after it has had a preliminary 40-sec. cooling in the forming mold. Rapid fixing is obtained by immersing the assembly in cold water.

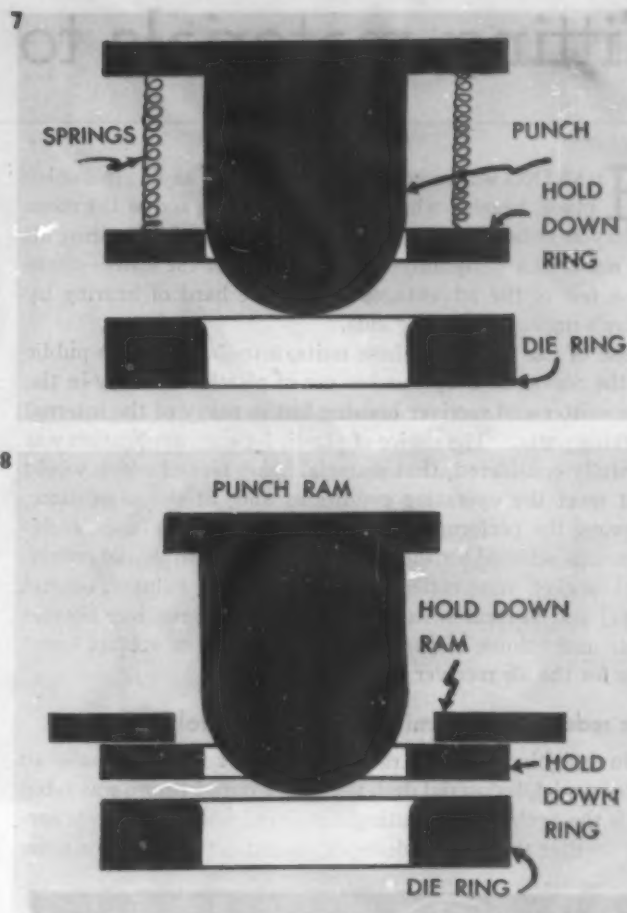
Pressures required for forming are in the order of 5 to 100 p.s.i. Simple bends and thin materials require relatively little pressure; deep-drawn sections, complex shapes and thick parts require much more. A pressure of 20 p.s.i. was used to form 1/10-in. plate stock into the cable guard.

Blanks used for forming are customarily cut in multiple. Up to ten sheets are cut at a time depending on the thickness of the material and the complexity of the job. Holes in the finished piece may often be drilled or punched in the blank prior to forming and used as locating devices for positioning the material in the die. If possible, it is desirable to cut and form a piece to the finished dimensions. Simple shapes with a manufacturing tolerance of 1/32-in. or greater are usually formed in this manner. Deep-drawn and complex shapes are practically always fabricated after forming.

Drawn shapes

Deep-drawn parts such as cylindrical cups, round-bottom shapes and boxes are formed in molds of the type illustrated in Figs. 7 and 8. Molds similar to the one sketched in Fig. 8 employ a double-acting press and are costly. Their use should be limited to the forming of large numbers of pieces or shapes of large dimensions. A spring pressure hold-down ring such as shown in Fig. 7 will give the same holding action as the double-acting press and is much cheaper. For the maximum drawn depth of a given shape, the hold pressure on the ring should be adjusted to the minimum required to prevent wrinkling.

Full-drawn shapes with smooth contours are formed with only a die ring as the female member of the mold. More



7 and 8—Deep-drawn parts such as cylindrical cups, round bottom shapes and boxes are formed in molds employing a spring acting press (7) or a double-acting press (8)

complex contours require a female counterpart of the male mold. While the best rule is to provide a hold-down ring for drawing, very satisfactory boxes have been full drawn without it. This is accomplished by adjusting die clearances to give the correct ironing action. Parts not subject to severe draw are often formed in this manner.

In deep drawing, the depth to which a part may be drawn increases with an increase in radii. For cylindrical cup shapes the depth of draw h is equal to $\frac{R^2 - r^2}{2r}$, where the blank radius R is the limiting value and r is the cup radius. The index of formability r/R has been found to be 0.67 to 0.77 for good hot drawing laminates in sheet thickness from 1/32 to 1/16 inch. The depth to which a part may be drawn will decrease with increasing material thickness. Increased drawing properties are sometimes accomplished by soaking the material in water for a period of several hours prior to heating it for forming.

Postwar applications

At the present time, hot-formed phenolic laminates are widely used in aircraft manufacture. Ammunition chutes, ammunition boxes, feed hoppers, data cases, fairings, cable guards and air ducts are typical examples. In all cases the material is employed for semi-structural and non-structural parts. Postwar uses for this material will continue to be found in the aircraft field. Laminated plastics are of much interest to aircraft engineers due to the fact that they weigh only half as much as aluminum and possess an excellent strength-weight ratio.

Fitting materials to the part

HEARING what somebody next to you is saying in a noisy place, hearing what someone is saying across the room when you've been talking to someone at your side, hearing all the music in a symphony—not just a few of the notes—these are a few of the advantages offered the hard of hearing by today's improved hearing aids.

One of the newest of these units, introduced to the public by the Sonotone Corp., makes use of plastics not only in the transmitter and receiver housing but in many of the internal working parts. The choice of plastic for each application was carefully considered, that material being picked which would best meet the operating conditions and, at the same time, improve the performance of the unit. On this basis, melamine was selected for the case, cord plug housings and covers, cord socket receptacle, receiver housing, volume control wheel and bi-focal switch; phenolic for the receiver bottom plate and volume control wheel; and cellulose acetate butyrate for the air receiver connection.

The redesigned transmitter case and control knob

In designing the new transmitter case, a modification of an older model, industrial designer Carl Conrad Braun was faced with the problem of creating a housing which, while appearing smaller than its predecessor, would actually hold a more

complex mechanism. The person who must wear a hearing device is always shocked at the thought of carrying a large instrument and pleased when the unit is so designed that it seems smaller than it is. With this in mind the case was shaped so that it came to a rounded point at the top.

This rounding off also serves to minimize the effects of clothing moving back and forth across the instrument case. In former models it was found that this movement caused vibration disturbance in the transmitter and sharp corners would tend to wear holes in the clothing of wearers.

For the convenience of the wearer, the volume control wheel is placed at the top of the instrument rather than at the side as in previous units. The case is cut away at this point so that the wheel can fit down in the housing and thus be shielded on two sides. At the front and back, however, the ribbed edge of the wheel protrudes slightly beyond the case to afford the wearer a firm grip when correcting the volume. This wheel combines the functions of the volume control and the off-and-on switch used in older units, an arrangement permitting a narrowing of the shoulders of the case.

Both the front and back of the case and the control wheel are compression molded. The two parts of the housing are molded in single-cavity molds; the wheel in a 4-cavity die. The wheel is so designed that the sprue can be broken off by hand, leaving no trace. This cuts down on the amount of finishing that is necessary.

Whereas black was the only color in which this company's hearing aids formerly were available, the new unit will be offered with flesh and black cases. Sample swatches of melamine were sent to users throughout the country to determine which colors they preferred. A large percentage of those voting selected the flesh tone. Women in particular expressed enthusiasm for this light shade, motivated no doubt by the thought of how inconspicuous such a hearing aid would be under summer dresses.

Two plastics—melamine and (Please turn to page 192)



Each of the plastic materials that are used in this redesigned hearing aid (above) was selected with a view to the operating conditions to which it would be subjected and to the effect its use would have on the unit's performance. Phenolic material is used for the housing; melamine, phenolic resin, cellulose acetate butyrate and vinyl resin for the various working parts, for the cord coating and plug



PLASTICS

Engineering Section

F. B. STANLEY, Editor



PHOTO, COURTESY GRUMMAN AIRCRAFT ENGINEERING CORP.



1—All Grumman "Hellcat" night fighters are equipped with radar units. The plastic radomes protect the radar transmitter, receiver and antenna, but do not interfere with the electrical impulses of the radar equipment

Radio Detection And Ranging[†]

THE story of Radar¹ begins in 1922 with some radio experiments carried on for the U. S. Navy by two civilian scientists. One of the men, Dr. Albert Hoyt Taylor, is today Chief Consultant and Chief Coordinator for Electronics at the Naval Research Laboratory. The other was Leo C. Young, long an associate of Dr. Taylor. Their immediate problem in 1922 was the improvement of interplane and plane-to-ground short wave communications.

For this work, the two men placed a transmitter in operation at the Naval Air Station, Anacostia, and then drove around to Haines Point, on the opposite side of the river, to measure, with a portable receiver, the transmitted signals. In the course of their experiments, they were occasionally annoyed by the fact that ships moving up and down the river distorted the transmitted signal.

It had long been known that large obstacles such as mountains distorted the pattern of broadcast radio waves, but not

that a small moving object would produce the same result. Dr. Taylor and Mr. Young initiated a report to the Navy Department ending with the revolutionary suggestion that with radio detection equipment, destroyers located in a line a number of miles apart could be immediately aware of the passage of an enemy vessel between any two destroyers of the line, irrespective of fog, darkness or smoke screen. Here was a concrete expression of the principle that was to lead to the development of radar.

Great advances have been made in detection devices since this early report and many more improvements are still being investigated and developed. But probably the most important advance resulted from a suggestion by Mr. Young that instead of steady transmitted signals, very powerful pulses be used. In this way he hoped to overcome the tendency of the transmitter to blank out the receiver when the two units were brought into close proximity, as aboard the same ship. At this point, Dr. Robert M. Page, who is credited by Dr. Taylor with "having made more contributions to modern radar than any other man," joined Mr. Young in this radio detection work. Their joint activities culminated

* Reg. U. S. Patent Office.

† All information of the production of the radomes supplied by Arthur H. Draper, project engineer, Andover Kent Corp. and Jack E. Stokes, technical representative, Bakelite Corp.

¹The history of the Navy's radar development was abstracted from a Navy release dated Aug. 14, 1945.



PHOTO, COURTESY EASTERN AIRCRAFT, DIV. OF GENERAL MOTORS CORP.

2—When newer, pressurized air-borne radar units were developed, sandwich construction was abandoned in favor of single skin construction. A radome of this latter type is used with the "Ash" radar on this TBM-3 torpedo bomber



ALL PRODUCTION PHOTOS, COURTESY ANDOVER RENT AVIATION CORP.

3—Before material is laid up for the construction of a radome, the male mandrels are thoroughly cleaned. Then three strips of standard crepe paper are stretched over the form, a rubber band being used to hold the ends in place. In the background are bundles of the material used in these domes which have been carefully weighed

in a set of radar, manufactured by the Naval Research Laboratory, being installed on the U. S. S. New York in the Fall of 1938.

For the next three months, this radar equipment was given exhaustive tests at sea during battle maneuvers. Personnel concerned with the tests were highly enthusiastic and strongly recommended that the development work be continued. In the meantime, the U. S. Army Signal Corps had been proceeding with developments at their own laboratories. Although Dr. Taylor, Mr. Young and Dr. Page were the three originators of radar, Dr. Taylor states that radar is not an invention but a development, and that many people are responsible for its present form.

Radar and its varying forms

Radar takes many forms. There are units for use on ship-board which give a visual plan indication of any floating object within a range of 50 miles. With the help of this equipment, every ship in a convoy can be kept in its designated position despite fog, darkness and poor visibility. Then there are other units which sweep the sky to detect approaching planes, give their distance, altitude, course and speed of approach. This particular equipment also operates with the gun director to direct accurately anti-aircraft fire.

There is also a type of radar which directs the fire of ship-board guns against surface targets. This unit not only keeps the target constantly under surveillance, feeding the correct range figures to the fire control officer, but permits the leader of the radar team to watch on a scope the progress of the shells as they travel from the muzzles of the guns to the target. In this way, the leader can spot where these shells land and even see the splash of water if the shells undershoot or overshoot the target. With this visual check, the radar team is able to correct immediately slight errors in range. They can even see the target sink if the fire has been heavy enough to cause this action.

And there are other types of radar—each with its specific job. One of the later developments, known as the "Ash" unit, is standard equipment on nearly all carrier-borne aircraft. Carried under the starboard wing, this radar equip-

ment is mounted so that it can be dropped like a bomb if the plane should get into difficulty. This jettison arrangement was worked out to prevent radar units from falling into enemy hands. The reciprocating antenna on this particular unit is used both in receiving and transmitting, and the entire radar assembly functions not only as a detecting unit for enemy planes, but as a gun firing director and an aid to the pilot in homing on his carrier.

Many types of radar are constructed so that only the parts that do not need protection are in the open. But where the tubes, antenna, in fact, all the working parts but the "scope" or scanning screen are exposed, some form of protection is needed for these parts. This protective covering, however, must not interfere with the transmission and reception of the high-frequency pulsations which are so necessary to the proper functioning of the equipment. When self-contained sets (such as are shown in Fig. 1) were developed, the problem of finding a non-interfering protective material became of paramount importance.

These coverings, known in the trade as radomes, were manufactured experimentally from many types of plastic materials. Both single skin and double skin with a sandwich core construction were tried out for these radomes. In the case of the P-61 Black Widow, the long opaque nose made up of two glass fiber skins separated by a hycar sandwich core, formed the protective covering for the radar equipment. Sandwich construction was satisfactory for this early radar equipment.

But when newer, more compact, pressurized units were designed, it was found necessary to pressurize the entire radar assembly in order to eliminate the possibility of arcing. This pressurizing plus other electrical complications caused by variations in wall thickness, which are characteristic of sandwich structure, ruled out this construction for radomes for the "ash" radar. A solution lay in the use of a single skin construction.

Collaborating with Bell Telephone Laboratories and the Western Electric Co. who is one of the prime contractors on the job, Andover Kent Aviation Corp. worked on the problem. It occurred to one of their engineers while in the laboratories of the Bakelite Corp., that the use of one of the resins newly developed by this materials manufacturer might solve the problem of the dielectric constant of the laminate. A sample of this resin was sent to M.I.T. Radiation Laboratories which reported that this resin showed a lower dielectric



4—The mandrels, wrapped with crepe paper and a reinforcing sock, are dried in an infrared drying tunnel to remove all the salt from the acetate stripping compound



5—After drying the mandrels are wrapped with a specially woven glass fabric which clings tightly to the form

6—This section of the U-shaped production line shows the domes being wrapped. The forms in the center of the line have bundles of trim on their tops. At the end of the line, almost out of sight, is the section where the resin is poured



than any resin they had checked up to that time—that is, up to 1943. In an effort to increase the strength of the dome, this same engineer collaborated with a cotton mill in New York in developing a specially woven glass fiber cloth which is now being used for the production of these domes.

Many problems were met and overcome during this trial period. As the accompanying photographs indicate, Andover Kent Aviation Corp. set up a straight line production which can produce these radomes economically despite all the problems involved in their construction and which will lend itself to the economical production of almost any type of



7—In the foreground the cotton reinforcing strip that is slipped over the mandrels is being measured. The next operators in the production line are pulling on the socks



8—After wrapping, the excess material is trimmed from the nine glass fabric socks and placed in a bundle on the top of the dome. Later this excess is weighed in order to determine the exact weight of the lay-up

low-pressure bag-molded parts. For this production scheme, a U-shaped line was devised—the cured parts being received from the autoclave at one end of the U while the mandrels, wrapped with resin-impregnated cloth, are ready for curing at the other end.

The male mandrels used in this bag-molding operation are thoroughly cleaned after each cycle, preparatory to the next lay-up. They are then coated with a cellulose acetate parting solution. Three strips of standard crepe paper are stretched into place (Fig. 3) so that they will completely cover all sections of the mandrel. The use of crepe paper is an important development in this type of molding—greatly increasing the quality of the inside finish of the molded part due to the fact that the paper gives a much smoother surface than other previously used parting materials. With these strips of crepe paper held in place with a rubber band, a cotton sleeve is drawn over the mandrel (Fig. 4). In this condition, the mandrels are placed in an infrared drying tunnel where the acetate solution is completely dried out.

The glass fiber weave cloth that was specially developed for these domes is delivered to the company in the form of a continuous sleeve or tube. A pattern is laid out on the sleeve in such a way that when the material is cut to size and sewn along a predesignated line, the cloth fits snugly and evenly on the nose of the mandrel (Fig. 5). A special sewing and cutting machine made by Wilcox-Gibbs was developed for this job. Operating at approximately 2000 stitches per min., it produces a special stitch which, when stretched, tends to lie flat and smooth. This does away with a heavy seam which would not be satisfactory for the job.

Nine of these glass fiber socks are the normal lay-up. But before any of them are placed on the mandrel, they are all carefully weighed and a record of their weight placed with each load. As the socks are slipped onto the mandrel, one after the other, there is a certain amount of excess material at the bottom which must be trimmed away. This excess



9—After the resin is poured over the laid-up dome, the entire assembly is wrapped in cellophane. Seemingly the resin is applied in a most haphazard manner, but this uneven distribution is fully corrected in the autoclave

heme,
ceived
adrels,
curing
on are
o the
cetate
er are
pletely
is an
reatly
d part
surface
these
nd, a
n this
trying
d out.
eloped
n of a
sleeve
sewn
venly
g and
d for
mit.,
ds to
which

But
re all
with
one
terial
excess

the
ngly
this
lave

is not discarded, however, but is saved so that the operators will have a way of knowing just how much material has been used in each radome, just how much has been trimmed away. A view of the production line (Figs. 6 and 8) shows some of the domes with the trim or tare resting on top of the noses. Careful weight control is very important since empirical formulae have been developed that control the exact weight of resin used for the impregnation of the cloth on each dome. It is only when the exact net weight of the lay-up is determined by carefully deducting the tare from the original recorded weight of the nine socks that the required weight of resin can be calculated. In no other way can the amount of resin impregnation be held within the ± 3 percent tolerance necessary for the production of satisfactory radomes.

Figure 9 shows a rather interesting yet puzzling operation. The young lady with the pitcher is pouring a predetermined amount of resin on the dome. Apparently no attempt is made to spread this resin evenly over the surface of the cloth. In the next operation (Fig. 9) the required resin is, to all appearances, allowed to drip in a helter-skelter manner down the side of the dome as a cellulose nitrate covering is wrapped around the dome preparatory to its being covered with a rubber bag and placed in the autoclave.

Obviously, domes that meet the requirements of the Armed Forces could not be produced unless some effort were made to spread the resin uniformly over the entire area of the lay-up. Needless to say, the resin is spread uniformly. But this work is done in the autoclave during the first part of the curing cycle by a method which is held confidential by the company.

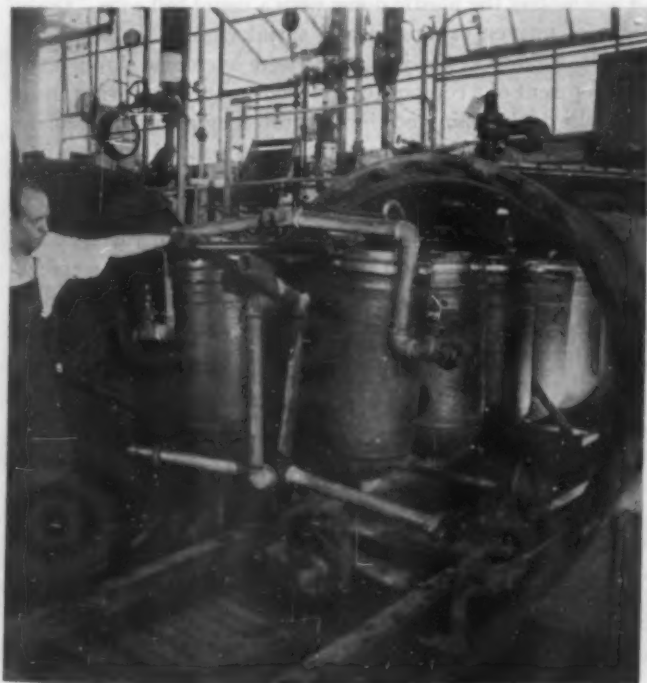
The new resin used in the construction of these domes is a cross-linked styrene alkyd combination which is mixed with the proper catalyst and a red pigment (iron oxide) just before it is poured on the domes. The iron oxide is needed to produce an opaque rather than a translucent molded part. Opacity is a very important property in these domes. Should any light

from the radio tubes enclosed in these radomes show through the wall of the dome, it could easily be seen by the enemy.

After the rubber bag is sealed around the radome lay-up, the uncured parts are mounted on a rolling car which handles 24 domes at one time. The piping arrangements, which make close control of the curing possible, are then connected. Figure 10 shows a complete load of domes being rolled into the autoclave. It is during the first 20 min. of this autoclave cycle that the resin is handled in such a way that it completely and uniformly impregnates the lay-up. From then on, for a period of 2 hr., the temperature is raised according to



12—These radomes have just been unloaded from the cooking car and the rubber bags removed. A compressed air jet is being employed to blow off the cellophane



10—After the rubber bag is sealed around the radome lay-up, the uncured parts are mounted on a rolling car which handles 24 domes at one time. Then, the load of radomes is rolled into the autoclave



11—This photograph of the interior of the plant illustrates the speed of production involved in this job. Twenty-four plastic radomes have just been withdrawn from the autoclave after they have been cured



13—The radome plastic skin is removed from the steel mandrel by compressed air. This air is blown through the top of the male radome mandrel



14—After the plastic domes are removed from the steel male mandrels they are cut to length on a motor driven arbor. The machine is set up so that the thin grinding wheel comes in from the side as shown in this picture

a predetermined formula until it reaches 300° F. where it is maintained for the last hour.

After curing the carload of 24 domes is pulled out of the autoclave, the lay-ups disconnected, and the rubber bag and cellophane coverings stripped from the cured parts. The domes are air blown from the mandrel and cut to length.

At this point, the first of many inspections and tests take place. First, the dome is inspected for porosity and light transmission, then a few points are spot checked with a microscope.

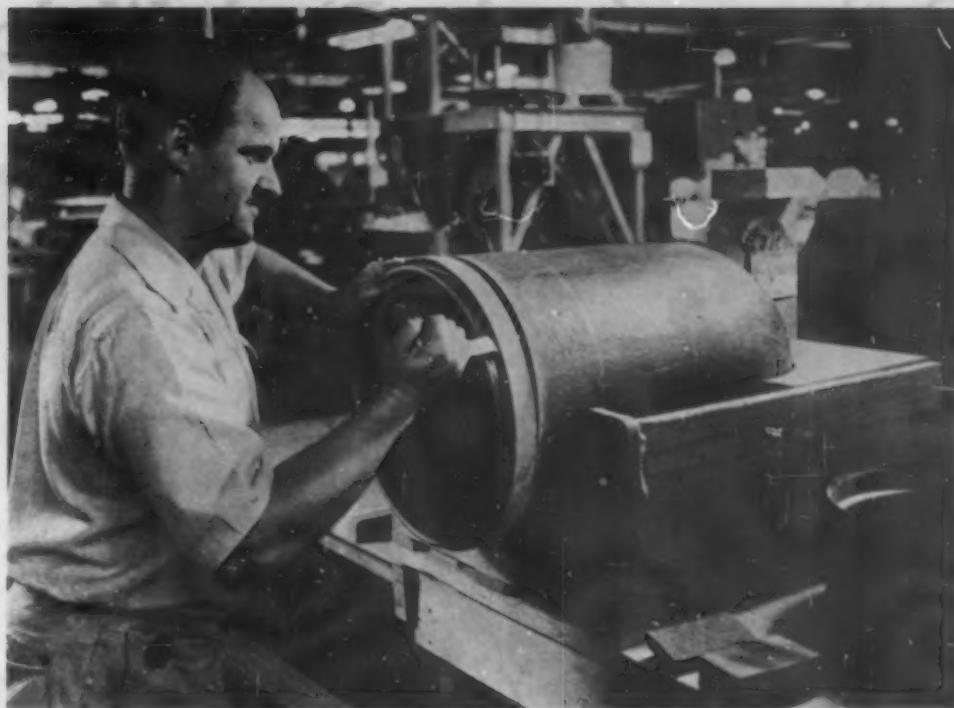
One more important problem remained to be solved—that of assembling the plastic dome with a metal tail cone. Questions of uneven expansion and shrinkage of the metal and plastic, leakage at the joint, etc., were overcome through the development of a composite part made up of a steel ring and a phenolic duck laminated ring separated by a chlorobutadiene polymer ring. These three parts are all bonded together in a mold, the synthetic rubber being vulcanized during the 20-min. curing cycle during which the temperature is maintained at 300° F. This rubber separator takes up all variations in shrinkage. The plastic ring forms the outside of assembly.

The ring assembly is press fitted into place on the inside diameter of the dome, where it is bonded in position with a low-temperature phenolic adhesive. This adhesive cures at 120° F. during an overnight curing period. Two additional rings of phenolic duck laminate, $\frac{3}{8}$ in. \times $\frac{3}{8}$ in. in section, are assembled inside the dome to stiffen the shell.

Inasmuch as the resin surface of the radome does not take a good paint job, the company manufacturing the parts found it necessary to break the surface with sandpaper. Once this is done, good paint adhesion is obtained. At this stage in the production, additional tests are necessary to insure that all parts will perform satisfactorily, that the weight of the dome does not vary outside of the tolerances, which are from 8 lb. 4 oz. to 9 lb., and that the thickness of the dome does not vary more than ± 0.005 inch.

While it is true that this radar unit is pressurized at only 5 p.s.i., this pressure is set at sea level. When a plane equipped with one of these units hits the 20,000 ft. level, internal pressure often runs as high as 15 p.s.i. Because of this in-

15—The problem of assembling the plastic dome with the metal tail cone is solved by the use of a composite part made up of a steel ring and a phenolic duck laminated ring separated by a chlorobutadiene polymer ring. Here the dome skin is stretched over the ring assembly with a special tool prior to the curing of the glue



crease in internal pressure, it was decided that an 8-hr. hydrostatic test at 25 p.s.i. was necessary to pick up any structural weakness in the domes. Once they have passed this test, the domes are put under pressure at 15 p.s.i. and sealed. Accurate instruments register the loss in this pressure due to diffusion. If the loss exceeds 0.2 lb. per hour over a period of 10 hr., the dome is automatically rejected.

The dome is then given a collapse test, during which it must stand a vacuum of 9 in. of mercury. The reason for this test is that if a slight leak should develop in either the metal or plastic parts or in the assembly ring when the plane is at a high altitude, the dome would not only lose its sea level pressure but its internal pressure would be reduced to that of the surrounding atmosphere. If the plane were suddenly to dive to sea level with the dome in such a state of vacuum, the atmospheric pressure would exert such a terrific force on the radome as to cause its collapse.

Even after inspection by both the U. S. Navy and the prime contractors, the units are still not ready for shipment. Each two days' production is placed in segregated storage and one dome picked at random for type tests ending in destruction. The first of these tests covers a period of 150 hr. in a room maintained at a temperature of 135° F. with a 97 percent relative humidity. During the entire 150-hr. test period, the domes have an internal pressure of 5 p.s.i. This is known as the "conditioning" cycle. Load tests follow this "conditioning." With the domes under an internal pressure of 23 p.s.i., nose loads and side loads simulating flight conditions are set up. These loads run between 1000 and 1100 pounds.

Having passed this test, the same dome is carried into a hot-cold cycle test. This test, extending for 24 hr., cycles the dome from -40 to +135° F. During all this time, the dome is under sealed pressure, the leakage being accurately measured with a total allowance of only 0.2 lb. per hour over the entire 24 hr. cycle. In the final test the dome must withstand the very excessive pressure of 30 p.s.i. for 3 min. without structural failure. And at the end of all this, a high vacuum is used to destroy the dome. Only at this point is the two days' production released for shipment.



16—These test stands for hydrostatic tests show the plastic radomes under 25 p.s.i. internal pressure

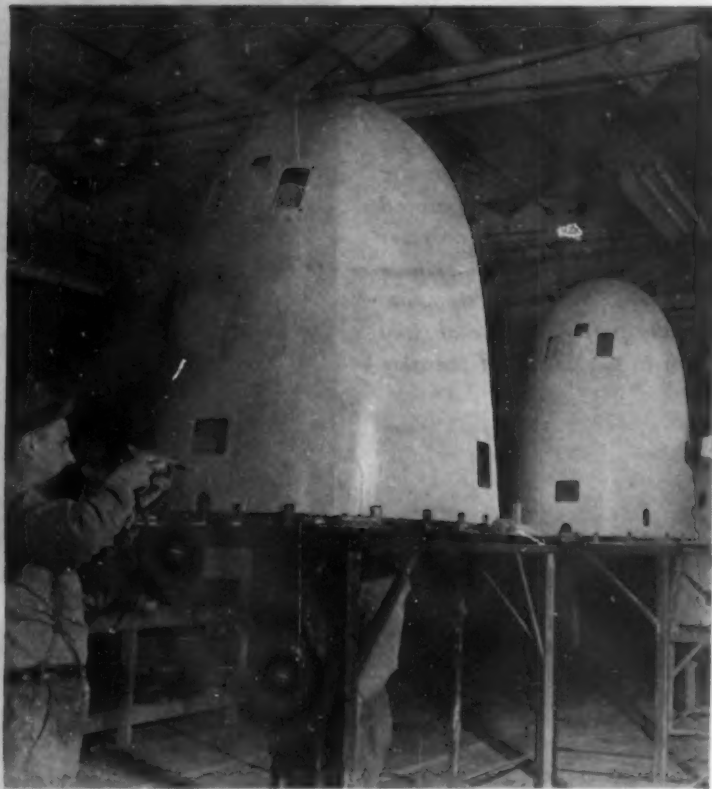


17—These domes are stored in racks for processing purposes

Radomes for the Black Widow



ALL PHOTOS COURTESY VIRGINIA-LINCOLN CORP.



1—The nose of the Black Widow is used to house the radar unit. Here in the Virginia-Lincoln Corp. the glass fabric impregnated with polyester styrene (Bakelite) resin, is first wrapped on a male form. This structure is then transferred to a cast iron female mold for curing under heat and pressure. 2—After the nose structure of this P-61 night fighter has been molded under heat and pressure it is removed from the female cast iron form and set up on a raised platform for ease in finishing. Here holes are being bored in the noses for insertion of inspection plates



3—Inspection plates have been inserted in this finishing line. It remains only to paint these plastic noses with a coating picked for its good electrical properties. 4—The nose of the P-61 "Black Widow" night fighter is attached to the plane by four magnesium castings. Here the metal attachments are assembled to the molded nose

Molding for quantity and quality

by FRED W. SAMPSON

A new molding technique, a new mold design and a special type of resin—these are the elements which work to produce fire-fighting horns of phenolic resin impregnated canvas duck

FIRE-fighting equipment, to be effective, must be ready at every emergency and available in the needed quantities. With cargo vessels of all types crossing and recrossing the oceans of the world loaded to capacity with all manner of flammable goods and with factories working full blast on needed equipment, these two qualifications presented a tremendous problem to manufacturers of all types of extinguishers.

For example, in the case of molded horns, which form the nozzles for portable fire-fighting equipment, considerable difficulty was experienced in producing satisfactory parts, in the needed volume, by compression molding. Using this method a flash bead was left on the part which reduced its impact strength.

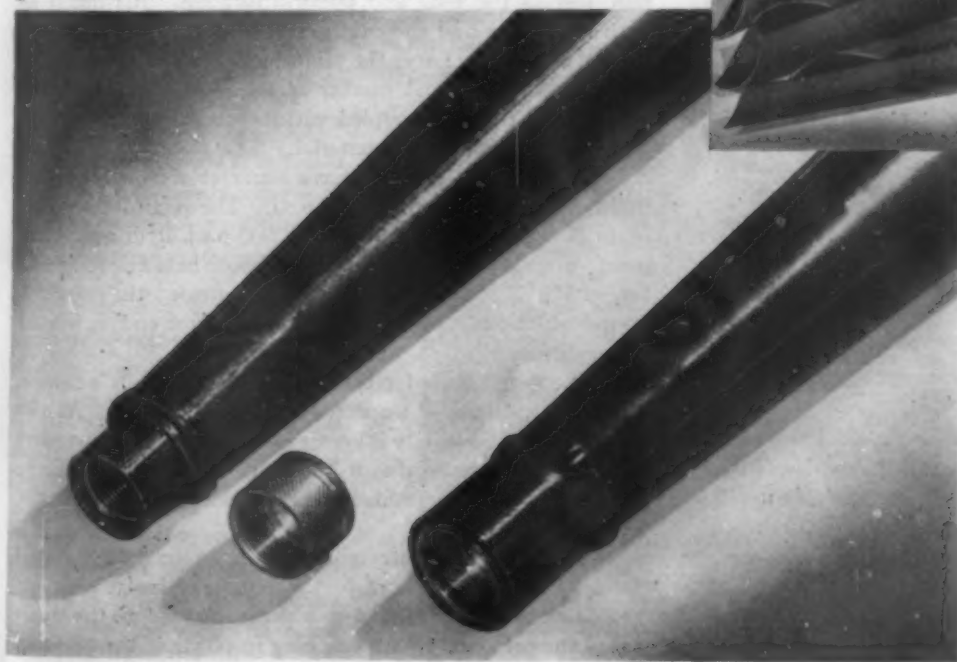
In view of these difficulties with compression-molded horns, an Ohio molding company undertook to devise a new method of molding these parts. Their revisions in molding methods produced a horn with an average impact strength of 25 ft.-lb. and a minimum impact strength of 22 ft.-lb. This compared to the 15 ft.-lb. called for in the specifications.

Many difficulties were encountered in the development of a new molding technique. Chief among these was the design of the horn which does not readily lend itself to the building of a suitable charge for molding. Certain of the horns have varying wall thicknesses; all the models call for critical tolerances to permit proper installation of inserts and are designed with external collars and beads so that they may be hung on the fire extinguishers.

The first difficulty, that of uneven wall thickness, was overcome through the use of a non-uniform material build-up. Problems of tolerances, inserts and threading were found to be closely related to the material used in the molding of the part.

* Chief engineer, Inland Mfg. Div., General Motors Corp.

PHOTOS, COURTESY INLAND MFG. DIV., GENERAL MOTORS CORP.



Inconsistencies, apparent in all the impregnated canvas duck used for this horn, were finally corrected through the cooperative efforts of the molder and the company to whom all the material had been subcontracted. It was discovered that the use of a lighter fabric was necessary to secure fabric in the threads, not just pure resin.

Preforming the impregnated canvas

The first step in the molding of these horns actually takes place outside the molding plant, at the company to whom the



1—The fire-fighting horn (left upright) is molded from a preform (right of horn) consisting of five sections of resin-impregnated duck (lower right) rolled over a mandrel

2—Two methods of obtaining an internal thread in the horn are used: one, by means of a brass insert pressed in after molding (right); the other, through a thread molded directly in the material



3—After the pattern has been laid out on the impregnated material, sections of the preform are cut by hand. 4—The various shaped sheets of resin-impregnated duck are rolled on a mandrel in order to shape the preform correctly

impregnation of the material had been subcontracted. Here the material is impregnated with a special phenolic resin and then it is wound up on large rolls for shipment to the plant of the molder.

Two large sheets of material and two or three small ones are needed to make the preform for one horn. These variously shaped patterns are laid out in the plant of the molder on a large sheet of the impregnated canvas and subsequently cut with scissors by the operator.

A wooden mandrel, the approximate shape of the finished horn, is used in order to shape this material. The patterns of impregnated canvas are rolled, one after the other, on the mandrel—care being taken that each piece of cloth is rolled into its exact position. The last lap of impregnated canvas is welded in place at three points with a soldering iron. This is to prevent the patterns from slipping out of position. The wooden mandrel is then withdrawn and the sheet material holds its shape—that of a slightly flaring tube—prior to the molding process.

Since there are three types of fire-fighting horns, there are three distinct build-ups for these parts.

1. A uniform preform for molding a horn of even wall thickness which has no threads.

2. A uniform wall preform with an extra heavy smaller end into which a threaded brass insert is driven after the horn is molded.

3. An unequal wall preform with a heavy core of light fabric at the smaller end in which is placed a threaded insert that molds threads in the horn.

A novel mold design

The mold for these horns is rather novel, the motion of the force plug, when under pressure, being horizontal. The upper half of the mold is held in position on the stationary head of the press while the lower half is fastened to the movable ram. The blueprint (Fig. 8) shows this mold layout. It should be noted that the end of the force plug nearest the horizontal ram is hinged vertically. This design permits the outer end

of the plug, the end with the smallest diameter, to pivot up and down.

With the cavity in the open position and the force plug retracted horizontally, the tubular preform is slipped over the plug (Fig. 7). A vertical ram is then set in motion, which serves to close the molds around both the force plug and the preform.

Because of the tapered shape of both the force plug and the cavity, the space between these two, when the plug is retracted horizontally, is much greater than the wall section of the finished horn. Because of this fact, the cavity can close without danger of any fabric being pinched on the cut-off—a difficulty which was encountered in previous attempts to mold this fire-fighting horn without the use of a retractable force plug.

With the cavity closed, pressure is put on the horizontal ram, forcing the plug and preform forward. Inasmuch as both force plug and the cavity are tapered, this horizontal motion of the plug forces the preformed material into a space which gets smaller and smaller as the force plug advances. Pressure on the plug coupled with heat causes the resin to flow to the surface of the material.

The horizontal ram, which has a diameter of 6 in., is pushed with a hydraulic pressure of 400 p.s.i. The vertical ram is 21 in. in diameter and operates with 2000 p.s.i. hydraulic pressure. The cavity and the mandrel are both held at a temperature of 350° F. The cavity is heated by steam; the mandrel, wound with a resistance band around the large end, is heated by conduction.

After a 4-min. cure for threaded nozzle forms or a 2-min. cure for non-threaded nozzles, the mold is opened. As the bottom half of the cavity is lowered, the force plug or mandrel tips slowly downward due to the hinge at the back or large diameter end. The molded horn is then slipped from the force plug.

Some of the horns are molded with an internal molded thread. With this type of part, a plug-type insert with external threads running into a shoulder is slipped into the small end of the preform. With this plug in position, the preform



is placed on the mandrel and the molding continues as described in the preceding paragraphs. The molding operation complete, the threaded plug and molded horn are slipped from the mandrel and the threaded plug unscrewed from the horn, leaving perfect molded threads on the inside of the horn.

Preparing the molded horn for shipment

The finishing operations are fairly simple. Some resin has flowed into the cut-off points at the split line, and this thin flash is easily removed with a knife or scraper. The horn is cut to length using a holding jig and band saw, and the raw surface of the cut end burnished by being pressed on a gas-heated metal plate.

If a non-threaded horn has been molded, a brass insert with a fine diamond knurl on the outside is assembled into the small end of the horn. An arbor press forces this insert into place. Although the specifications state that the grip of the plastic horn to the knurl insert must be sufficient to withstand a 200-lb. dislodging load, the friction between the metal and plastic parts has often been sufficient to withstand a 1400-lb. load. Repeated assembly and disassembly of these horns have made little difference in the pressure needed to dislodge the insert.

(Please turn to next page)

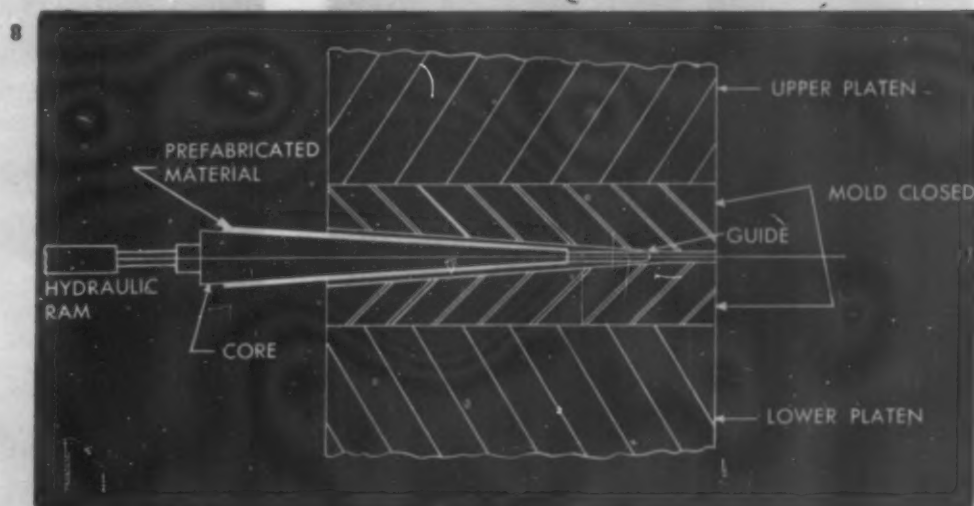


5—After the preform is rolled, it is tacked in several places with a soldering iron to retain its shape on removal from mandrel

6—The mold is open and the horizontal force plug in position to receive the preform

7—An operator has placed the conical shaped preform on the mandrel before closing the mold

8—Sketch of the unique mold layout which employs a horizontal motion of the mandrel to attain molding pressure





One company for whom these horns are being made has insisted upon playing even better than safe. They have specified that a $\frac{1}{4}$ -in. hole be drilled through the side of the horn and the brass insert. A standard screw is then driven into place, eliminating any possibility of the insert becoming dislodged under pressure. In the remaining finishing operations the horns are painstakingly buffed along the parting line and around the mouth, carefully inspected and packed for shipment.

Unless the operators on this job are highly skilled, there is likely to be a very high percentage of scrap. This scrap comes mainly as the result of blisters and damaged threads, from horns that are porous or not filled out, from pieces whose dimensions are off, and from finishing scrap. However, the operators are not the only controlling factors. For example, off-dimensions may be due to such mechanical defects as over-size thread inserts and the bad location of the cut-off saw. Location and relative position of the charge, mandrel and mold cavity can be blamed for horns that have not filled out, while damaged threads may be attributed to incorrect molding or finishing. There are various causes for porosity—low resin content, the flow characteristics of the resin, variation in wall thickness, poor mold surface and spotty heating. Highly volatile material, material that has been exposed to moisture, and improper breathing of the mold during curing often are to blame for blisters.

9—The mold immediately after it is opened, with the molded horn still in place on the mandrel. 10—A very small amount of resin flash remaining on the part is quickly trimmed from the parting line with a knife. 11—Since the flow of material in the mold is not restrained by any portion of the die, the result is a horn longer than is required. The excess in length is trimmed off by means of a bandsaw. 12—Those horns requiring a brass thread have the externally knurled insert pressed into the throat of the horn after molding.

12



A new technique and a special resin

Not only is the molding technique new but the mold design calls for a very special type of resin and a very careful control of this resin during production. As can be seen from a glance at Fig. 8, this mold is so designed that there is no cut-off at the large diameter end of the mold. In other words, a tapered plug is placed in position inside a tapered cavity so that at no time do the walls of the two come in contact and so this space is closed off at only one end with metal. The only blocking is done by the material itself.

The 8.6-oz. duck is impregnated with a special phenolic resin, 50 percent of resin by weight, with a permissible tolerance of plus or minus 2 percent. A quality control laboratory at the molding plant checks the properties of each shipment of resin. The flow test is one of the very important quality controls that have been found necessary since a free flow resin would flow out of the large end of this mold where there is no positive cut-off.

This flow test uses three plies of impregnated fabric under 1200 p.s.i. with plates heated to 325° F. Under this heat and pressure, the resin must flow out 21 to 26 percent of its weight. Experience has shown that if the resin flows less than 21 percent the material will be too hard and will not fill out, resulting in porous horns. If the flow is over 26 percent, the resin segregates from the duck and light, low-strength horns result.

Through the successful combination of a new molding technique, new mold design and special resin these fire-fighting horns are now meeting the wartime need for fire extinguisher equipment. In the future these same elements in addition to supplying civilian needs for fire-fighting apparatus may help solve a number of other problems relative to postwar applications.

Credit—Material: resin, Bakelite; impregnated canvas, Cincinnati Industries, Inc. Horns molded by Inland Manufacturing Div., General Motors Corp.

Transparent gage aids assembly work

GAGES made from transparent plastic material have been used with good results on production work and in the inspection of instrument assemblies. There are five outstanding advantages in the use of transparent plastics for these gages: 1) Plastics make for economic gage production, 2) they are easy to machine, 3) they wear well, 4) they are light in weight and easy to handle, and 5) they give the operator an unobstructed view of the part during inspection.

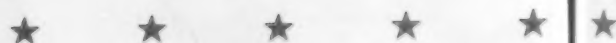
Figures 1 and 2 illustrate the way this type of gage can be used. The part to be inspected (Fig. 1) is a cover for an electrical instrument with a grounding spring (a) riveted to one side. The spring has a dimple (b) which makes contact with a part on the inside of the apparatus after the cover is assembled in position and must be compressed flat against the cover as shown at (c). The transparent plastic gage (Fig. 2) is used to determine the position of the dimple (b) in the compressed position. The three holes (d) are used to mount the cover on the instrument, round-head standard screws being employed for this assembly.

The gage is made from $\frac{1}{8}$ -in. thick stock and has three plastic buttons attached to it in positions that match with the centers of the holes (d) in the cover of the instrument. The diameter of the buttons are a slip fit into these cover holes. A dead center is marked with two lines (e), and this center is the exact position of the dimple when it is in the compressed position. By placing the buttons on the gage in the four holes in the cover and pressing the two parts together until the spring on the cover is in a flat position, the inspector can see whether it is in line with the center (e) as marked on the gage.

Credits—Gage designed by A. S. Arnott.



1—This cover for an electrical instrument has a grounding spring (a) riveted to one side. The spring has a dimple (b) which makes contact with one section of the apparatus beneath the cover and must be compressed flat as shown at (c). 2—The transparent gage is used to determine the position of the dimple (b). It is made of $\frac{1}{8}$ -in. thick plastic sheet stock and has three raised buttons



Electric Razors with Plaskon Housings

give clean, speedy shaves to servicemen

★ Recently, when Remington Electric Shavers went back into limited production, they were allocated for the exclusive use of hospitalized servicemen, and airmen whose faces are susceptible to frostbite.

The housings for these new Remington Electric Shavers are Plaskon Molded Color. This versatile plastic material lends many worthwhile advantages to the Remington Shaver.

Plaskon Materials can be molded into almost any desired shape, permitting unusual opportunity for handsome, practical designs in large quantities at very economical cost. They are available in a wide range of beautiful, permanent colors.

Plaskon Materials are strong and non-

shattering, with a smooth, warm-to-the-touch surface that remains gleaming and sanitary. They are unaffected by oils or fats; alcohol, acetone, or any common organic solvents; and are odorless, tasteless and inert. They have high dielectric strength, and are completely resistant to arcing and tracking under high voltages and high frequencies.

Your products of today and tomorrow will enjoy profitable manufacturing and sales advantages if versatile Plaskon plastics can be adapted to their needs. Write for profusely illustrated booklet showing a great range of actual Plaskon applications to commercial and public needs. Experienced Plaskon men will gladly assist in adapting colorful Plaskon plastics to your individual requirements.

PLASKON DIVISION, Libbey • Owens • Ford Glass Company • 2121 Sylvan Avenue, Toledo 6, Ohio
Canadian Agent: Canadian Industries, Ltd., Montreal, P. Q.

PLASKON

TRADE MARK REGISTERED

MOLDED COLOR

Processing phenolic molding materials

by FRANK J. DONOHUE*

This is the second and final article of a series on phenolic molding materials. The first article, published in the August issue, described the various components of the resin and molding compounds. Here important physical and molding properties are discussed

Most phenolic molding resins reach the molder as molding materials. In this form, all the necessary ingredients—resin compound, color and filler—have been combined and thoroughly mixed, then kneaded or compounded on heated rolls, cooled and ground and finally thoroughly blended to insure maximum uniformity. The finished material is a dry, granular powder, of graded particle size, which is ready for use in the mold.

The most important production units at this stage of manufacture, and the principal means of controlling the plasticity of the molding powder, are the rolls or compounding mills. These consist of a pair of large steel rolls mounted side by side in a common frame and rotating toward one another. The spacing of these rolls in relation to one another is adjustable and each roll can be heated and cooled independently.

PHYSICAL PROPERTIES

The molding material ingredients, in the form of finely divided, dry powders, after a preliminary mixing in ball mills or ribbon mixers, are fed to these heated rolls. The resin melts and the kneading action of the revolving rolls impregnates the filler and thoroughly disperses the color, accelerator and lubricant throughout the mass. At this stage, also, the two-stage resins react with hexa present in the mixture and are converted to thermosetting types.

The sheeted material coming from the rolls is cooled, crushed and ground. Successive batches of the ground material are carefully blended to average out individual differences and produce a uniform compound. By selective screening, the granulation is controlled so that the finished molding powder will not contain an excess of coarse or fine particles.

* Technical Service Dept. Monsanto Chemical Co.

PHOTO, COURTESY MONSANTO CHEMICAL CO.



After the molding materials in the form of finely divided powder have been given a preliminary mixing in a ball mill, they are fed into heated rolls where the kneading action thoroughly disperses the various ingredients

The most important physical properties of a molding powder from the point of view of the molder are the following:

1. Granulation
2. Apparent density
3. Bulk factor
4. Pourability
5. Moisture content

Granulation, which refers to both particle shape and particle size distribution, may be considered the primary property on which apparent density, bulk factor and pourability depend. All of these properties, including moisture content, affect preforming and molding behavior.

Granulation

This depends for a given material, on the length of time a material is rolled, and the thickness of the sheet produced (roll spacing). It will also vary, among different materials, with the type of filler used. A cotton flock-filled material will, when ground, produce particles with a softer surface and more fibrous texture than material containing a woodflour or asbestos filler.

Also, any one of these materials, if rolled in thin sheets (narrow roll spacing) and for a considerable length of time (as when producing material of stiff plasticity) will be dense, hard and fairly brittle in sheet form and when ground will tend to form more jagged particles and have a wider particle size distribution. This tends to raise the apparent density, lower the bulk factor and improve pourability, all of which are desirable effects.

The average granulation of a general purpose woodflour-filled material is shown below. The particle size distribution is given in terms of the fractions retained on various sieves of the U. S. Standard series; the number given each sieve is the approximate number of screen openings per inch.

On 10 mesh	0 percent
On 12 mesh	0 percent
On 14 mesh	0 percent
On 16 mesh	0 percent
On 20 mesh	20 percent
On 60 mesh	35 percent
On 80 mesh	30 percent
Through 80 mesh	15 percent

It has been found by experience that this distribution gives the best average preforming and molding characteristics.

Apparent density

Apparent density of a molding powder is the specific volume or weight per unit volume of the loose material before molding. It is officially defined as the weight of loose powder that will occupy a standard volume of 100 cubic centimeters. Dividing this value by 100 gives the figure usually reported in molding material data. The smaller the value, the more flocculent and fluffy the material.

The apparent density of a given material will vary from

TABLE I.—VARIATION IN APPARENT DENSITY

Material	Type of filler	Apparent Q density range
		gram/cc.
A	Asbestos	0.75-0.86
B	Asbestos and woodflour	0.70-0.80
C	Woodflour	0.52-0.60
D	Cotton flock and woodflour	0.39-0.44
E	Cotton flock	0.25-0.30

batch to batch within a fairly narrow range. The variation among materials based on different types of fillers is considerably greater as can be seen in Table I.

Apparent density is a property of the loose powder before molding. It should not be confused with specific gravity which is determined on the molded piece. The apparent density of the loose powder depends in part, of course, on the specific gravity of the individual particles. But it is also a function of the granulation and of the consequent percent of "voids" or amount of free space among the particles.

It is not possible to increase the true specific gravity of a molding powder (by incorporating asbestos or other heavy mineral filler) without at the same time raising the apparent density, provided the same granulation is maintained. However, it is quite possible, by suitable rolling, grinding and blending operations, which change the particle shape and the percentage of fine and coarse particles present, to vary the apparent density within certain fairly wide limits, without affecting the molded specific gravity.

The following numerical example will illustrate this fact. Assume that Material A, under normal molding conditions produces pieces with a specific gravity of 1.35, and has an apparent density, in loose powder form before molding, of 55. This means that the molded piece is 1.35 times heavier than an equal volume of water, and that 100 cubic centimeters of the powder, from which the piece was molded, weigh 55 grams.

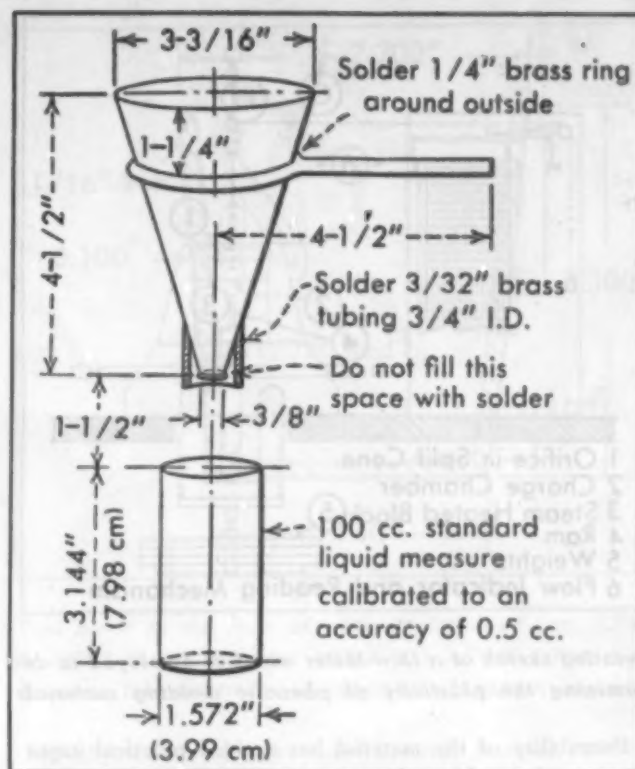
It is quite possible to have a second lot of Material A, identical in composition to the first, which also produces a molded piece with a specific gravity of 1.35, but has an apparent density of 60. The individual particles of this second lot are not any heavier, but the granulation (particle shape and size distribution) is such that a greater weight of material can be accommodated in the standard 100 cu. cm. volume.

Apparent density of the molding powder is important to the molder. He desires, in general, the highest apparent density possible in a given material. This means the material will occupy minimum volume in the mold, will not require a deep loading well to accommodate the necessary charge and will not tend to escape from the mold during closing. Similarly, in preforming, a high density material will form hard cohesive pills more readily and cause less wear on the preform die, because it will not require such severe compression as is needed with a loose, bulky powder.

Materials of extremely low apparent density may cause trouble in both the preforming and molding operation. In preforming it may be impossible to obtain the necessary pillweight even with the preform die opened to maximum depth. In molding, when a loose powder charge is used, it may be found impossible to accommodate enough material in the mold to produce a properly filled piece.

Bulk factor and pourability

This can be considered another aspect of apparent density. It is the ratio of the volume of the loose powder to that of the molded piece. It is also related to the apparent density and



DRAWINGS, COURTESY AMERICAN SOCIETY OF TESTING MATERIALS

This apparatus shows the type of equipment used to measure the apparent density of various molding materials

molded specific gravity according to the following equation:

$$\text{Bulk factor} = \frac{\text{Specific gravity}}{\text{Apparent density}}$$

$$\text{B.F.} = \frac{\text{S.G.}}{\text{A.D.}}$$

From this equation, as is readily seen, a value for any one of the three properties can be determined if the other two are known. It is also apparent that bulk factor varies inversely with the apparent density—as the latter increases, the former decreases.

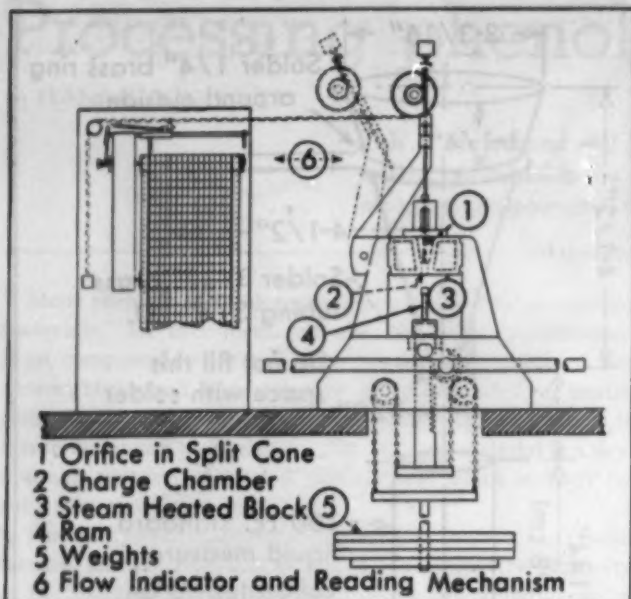
The bulk factor is higher for materials containing fibrous fillers than for woodflour-filled materials. The range of values for representative types is shown in Table II.

The molder desires, in general, a low bulk factor in the molding material, for the same reasons as cited under *Apparent density*. This makes both preforming and molding easier and less expensive, since the material can be handled in a smaller filling space in both the preform dies and the mold. Such a factor makes for less wear on preform dies, a less expensive mold, and fewer molding rejects due to non-uniform pillweight.

(Please turn to next page)

TABLE II.—BULK FACTOR OF VARIOUS MATERIALS

Material	Filler	Bulk factor
A	Chopped fabric	10
B	Long fiber cotton flock	4.50-6.50
C	Short fiber cotton flock	4.00-5.53
D	Short fiber cotton flock and woodflour	3.10-3.50
E	Woodflour	2.27-2.62
F	Woodflour and asbestos	2.10-2.40
G	Asbestos	2.02-2.32



Detailed sketch of a flow tester which is employed in determining the plasticity of phenolic molding materials

Pourability of the material has decided practical importance to the molder, since on many large volume molding applications the material must be preformed for fast and economical handling.

Pourability (a coined word) is a measure of the ease with which the loose molding powder will flow in the hopper of a preforming machine. It is measured by the time in seconds required to empty a standard conical funnel, with a $\frac{3}{8}$ -in. orifice and having sides at a 60 degree angle to the vertical, using a fixed weight—approximately 120 gm.—of material.

For any given material that pours readily, the rate will depend on the granulation and will be most rapid and uniform when the particle size is properly graded from fine to coarse. The average woodflour material has a pourability of 15 to 20 seconds.

Materials containing cotton flock fillers do not pour readily, and pourability becomes poorer as the fiber length or content of cotton flock is increased. The material tends to choke or bridge at the narrow throat of the preformer hopper. Materials containing cotton flock as the only filler usually cannot be satisfactorily handled in automatic preforming machines unless a positive mechanical agitator or magnetic vibrator is attached to the hopper and feed shoe at one or more points.

MOLDING PROPERTIES

The most important molding properties of a phenolic material are:

1. Plasticity
2. Cure time
3. Shrinkage
4. Specific gravity

Plasticity

This is the property of the molding compound which permits it to become semi-fluid when subjected to heat and pressure, and to flow and fill out the mold.

The plasticity of a thermosetting phenolic molding compound is inseparably tied up with the curing rate or rate of final polymerization. Although affected by other factors,

such as the amount, type and softening point of the resin used, as well as type of filler and moisture content, the plasticity is directly dependent on the amount of hot mixing the material receives during compounding on the rolls. The longer the material is rolled, the nearer does the final polymerization reaction approach completion, and the less plastic flow will the material have.

Plasticity of phenolic materials can be measured by a number of different methods, some of which are the following:

1. Tube base method
2. Peakes-Rossi flow tester method
3. Extrusion methods (including Plasticity Index Test)
4. Mold closing time method

All have the common purpose of indicating in numerical units the amount of plastic flow that will occur with a given material before final polymerization renders the mass hard and infusible, or, as is commonly stated, cure is completed.

Tube base test—The plasticity of granular cellulose and mineral-filled materials can be measured by this method. A multiple cavity flash mold is used and is mounted in a conventional compression molding press, using a fixed line pressure and constant mold temperature.

The test pieces, called tube bases, are short cylinders with closed ends, $1 \times 1 \times \frac{1}{8}$ in., resembling radio tube bases. Flow of the material is designated by a number equal to the number of these test pieces that can be produced under standard molding conditions, with an overflow or flash of standard thickness—0.007 to 0.009 inch. The thickness of this flash is carefully measured with a micrometer.

Under these conditions, if a given material will fill out six cavities in this mold, yielding six perfect test pieces and producing a flash of the standard thickness, the material is rated a "Flow 6" material. On the other hand, if the material is considerably "softer"—more plastic, not as near the end-point of final polymerization—and will under the same conditions produce sixteen completely filled pieces, with the same standard flash thickness of 0.007 to 0.009 in., it is rated a "Flow 16" material.

The test is an arbitrary or empirical one which does, however, provide a practical measure of the plasticity of the materials. Using this test it is possible to establish a continuous numerical flow or plasticity scale ranging from *hard* to *very soft*.

On this scale "Flow 5" designates a very *stiff* material, having only a small amount of plastic flow, which would be suitable for molding small closures or buttons; whereas "Flow 18" designates a very *soft* material, suitable for molding large machine housings, radio cabinets and other parts having deep vertical draw or complicated sections.

Cup closing time test—Plasticity of fabric-filled impact type materials cannot be satisfactorily measured in the tube base mold. For these a test piece in the form of a tapered molded cup 1.750 to 2.200 in. in diameter and 2.300 in. tall is used.

In this case, the time in seconds required to close the mold fully and produce a completely filled out piece, with constant molding pressure and temperature, is used as a measure of the plasticity of the material. This time will vary inversely with the plasticity, a longer closing time being required for materials of stiff plasticity and vice versa.

Significance of tests—It would be very desirable to have an exact correlation of plasticity measurements made in the laboratory by either of the above methods with performance in production molds, and thus be able to predict the flow in any given material required to mold a particular part. Un-

fortunately, the complex nature of phenolic materials and the pronounced and variable effect of commercial molding conditions and differences in mold design on their behavior, prevent this. Any such predictions are either experienced hunches or pure guesses.

A certain degree of correlation does exist, however, between standardized plasticity tests on any given material and the behavior of the material in a production mold. Thus, if by actual trial, we have established that a given woodflour-filled material, in Flow 8, molds satisfactorily in a certain production mold, there is reasonable assurance that successive batches of the same material, produced also in Flow 8, will perform equally well in this mold.

On the other hand, a mineral-filled material in Flow 8, might or might not mold satisfactorily in this same mold. We could not safely predict this until an actual test was made.

These plasticity measurements are valuable primarily as control tests, to insure uniformity and reproducible molding properties from batch to batch of each material. Careful blending of both resins and molding materials is done to achieve the same result.

The plasticity test methods used for phenolic materials throughout the industry are not as yet standardized. The values for competitive materials from different sources are, therefore, not directly comparable in all cases.

Cure time

Cure time of a phenolic material is the length of time the material must be held in the heated mold under pressure to complete polymerization to the final, infusible, insoluble state.

This is usually and most readily determined by measuring the minimum time required to prevent blistering of the molded part on ejection from the mold. Such blistering is caused by the expansive force of hot gases within the molded piece; if this is ejected from the mold before polymerization is completed, or practically completed, the mass has not hardened sufficiently to withstand this pressure. Such a piece is said to be undercured. Cure time depends on the following factors:

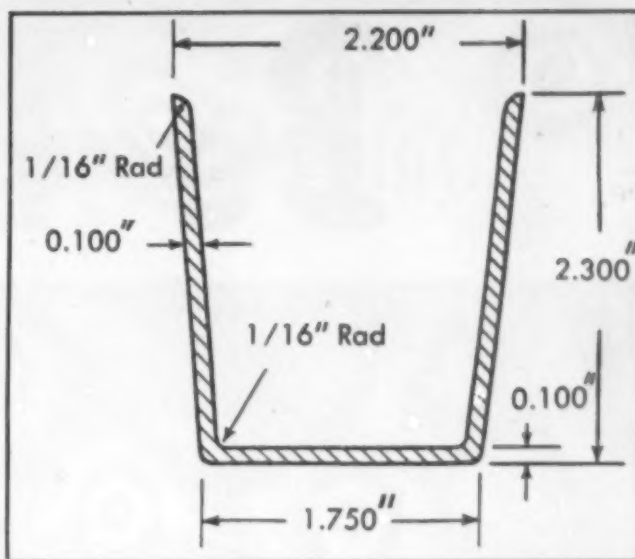
Type of resin—The more reactive the resin, and the more rigid its final set, the shorter will be the cure time of the molding material of which it is a part.

Plasticity—The degree of polymerization of the resin, as indicated by the plasticity of the molding materials, controls the cure time directly. Material of stiff plasticity will have a shorter cure time than a softer material.

Moisture content—The moisture content of a molding material will vary considerably in response to changes in temperature and relative humidity of the surrounding atmosphere. A cellulose-filled material can absorb as much as 6 percent moisture on long exposure to air at high relative humidities. The average normal moisture content of cellulose-filled phenolic materials varies from 0.75 to 2.5 percent.

Excess moisture has a profound effect on molding properties. When more than 3 percent is present, it acts as a plasticizer, increasing the plastic flow of the material. Cure time is also lengthened, because this excess moisture vaporizes at molding temperature and tends to escape from the material when the mold is opened, producing blisters on the molded piece.

To overcome this, the part must be held under pressure for a longer time in the mold. In addition it may be necessary to open the mold partially a number of times at the start of the curing period to release this excess volatile matter.



Test piece in the form of a tapered molded cup, 1.750 to 2.200 in. in diameter and 2.300 in. tall is used to measure the plasticity of fabric-filled impact material

Finally, excess moisture will frequently increase molding shrinkage and thus cause undersize dimensions and warpage in the molded part, particularly in thin, flat sections.

Molding temperature—The higher the molding temperature used, other factors remaining unchanged, the shorter the cure time will be, since the reactivity of phenolic resins increases rapidly with increasing temperatures.

Cross section of piece—These materials are inherently poor heat conductors. Hence, cure time increases rapidly with increase in wall thickness, because a longer time is required to conduct sufficient heat into the material to complete the cure.

Conductivity of the filler—The writer has found in field tests that a material containing a mixture of asbestos and woodflour filler, cured much faster than a straight woodflour-filled material, using the same resin. The result was borne out in subsequent laboratory tests and is attributed to the greater heat conductivity of the asbestos present in the filler.

Cure time is very important to the molder, particularly in highly competitive, large volume branches of the industry, such as closure and button molding. Other factors being equal, it absolutely fixes the maximum production capacity of a mold, determines production cost, and often means the difference between profit and loss on a molding job.

Again, this is a property of the material that cannot be translated directly from laboratory test specimens to production molds. Predictions cannot be made, except in broad, general terms. In general, comparisons made in the laboratory among a number of materials, will hold in the same relative order in a production mold, but there are notable exceptions to this rule.

It is quite possible for a given material to require twice as long to cure in one mold, as in another, due to difference in mold design (semi-positive versus flash mold), or to tight mold clearance (tendency to trap gas in the molded piece), or to differences in wall thickness in the molded piece (thicker sections show poorer heat transfer).

Since this is the case, the molder, when quoting on a new job, can only make the best estimate possible based on his previous experience with a given material and allow sufficient margin in his cost calculations to cover any unforeseen delay in the molding cycle.

(Please turn to page 196)

Beetle ...For Distinction...



BEETLE JEWELRY PACKAGES are smart and serviceable, and provide a quality background against which to display expensive merchandise. The re-use feature of many BEETLE boxes means actual appeal to the customers. Molded by Rathbun Molding Corporation for Electric City Box Company.

Distinctive BEETLE containers and closures for Charles of the Ritz cake rouge, cream rouge, and eye shadow are molded by the A. J. & K. Company.



Style...Beauty...Product Identity...

...All these qualities will mark your product when you use the colorful BEETLE* plastic. For BEETLE can, and does, help sell cosmetics, beauty preparations, and other items that depend on eye appeal for initial as well as repeat sales.

With BEETLE you have the assurance of a packaging material that is chemically inert, dimensionally stable, resistant to wear and handling, impact, and abrasion. You have, too, all the colors of the rainbow at your command. Besides that, BEETLE packages can be produced in large quantities at little cost.

Information about BEETLE, *the plastic that's all color in all colors*, for your packaging or design requirements will be sent on request.

*Reg. U. S. Pat. Off.



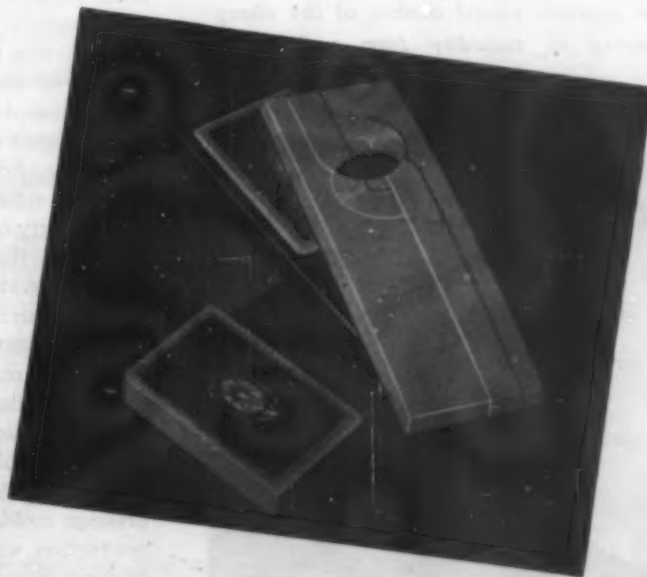
AMERICAN CYANAMID COMPANY • PLASTICS DIVISION
32 ROCKEFELLER PLAZA • NEW YORK 20, N. Y.

Cyanamid Plastics

*Beetle • Melmac
Melurac • Laminac • Urac*

◀ **HOUSINGS** for barometers, thermometers, and other instruments withstand wear and abrasion caused by constant handling when molded of smooth, shatter-resistant BEETLE. The BEETLE case for this "fisherman's barometer" was molded by Diemolding Corporation for the Taylor Instrument Companies.

▶ **NOVELTY CASES** can be streamlined for modern use with molded BEETLE. Its attention-getting colors, smooth lustrous surface, and light weight all add up to extra customer satisfaction. This attractive card case is molded of BEETLE by Northwest Plastics, Inc.





OFFICIAL PHOTO, U. S. NAVY

1—Water, one of the prime necessities of our forces in the far-flung area of the Pacific, is rendered potable by means of a highly simplified water-filtering unit

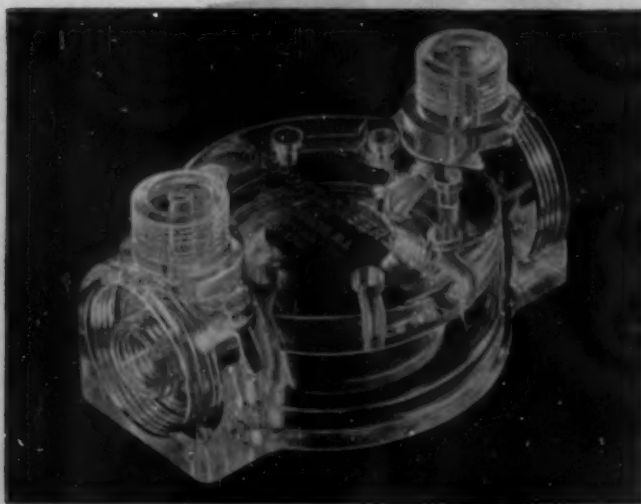
Injection-compression molding of acrylic feeder heads

In the development of a new water filtering unit for the Armed Forces the molder found that existing equipment could not cope with the problem presented by the wall thickness of the part. Consequently, a new type of injection machine was employed which incorporates all of the advantages of injection molding without losing the high pressure characteristics of compression molding

WITH so many of the Armed Forces stationed on remote and often primitive Pacific islands, there is a constant problem of providing ample quantities of potable water. Among the many methods of filtering water now in use is that of %Proportioneers, Inc.%. A smaller unit previously manufactured by the company, which made use of a sand filter, was described in an article that appeared in the March 1944 issue of this magazine.

The idea behind the development of a new unit was to pro-

2—A transparent feeder head with very heavy wall sections which makes possible visual control of the slurry used in the filtering of turbidity from raw water



duce a higher output of water per unit weight of equipment, to improve the quality of the filtered water and to simplify the complex chemical problems necessary to produce flocculation, that is, the removal from water by filtration of very fine turbidity or colored particles. In flocculation, myriad tiny jelly-like masses of chemical are formed in the water when a coagulant and an alkali are added in proper proportions. These particles of flock serve to entangle suspended matter in the water and are, in turn, filtered out along with the lower forms of animal life which cling to them. The old water-purifying unit made use of a sand filter and aluminum hydroxide flock. While doing a reasonably good job, it was subject to improvement.

In the new unit, the actual filtration is accomplished by a coating of diatomaceous earth supported on synthetically manufactured porous stone cylinders or metal screens. The diatomaceous earth is injected into the raw water in the form of slurry. Accurate and economical filtration is dependent upon the slurry being injected in amounts proportionate to the turbidity of the raw water.

Deciding that visual control of the slurry would be the most satisfactory, the filter company went to work on the designing of a transparent feeder head. An acrylic resin was selected for this important part of the feeder, shown in Fig. 2, wherein the filtering components are mixed.

Since the design of this acrylic head called for wall sections up to approximately 1 in. in thickness, the part immediately became a problem as far as the molder was concerned. A similar part, smaller and thinner in wall section, had been compression molded for the early type filtration unit, but the production was very limited due to a 1-hr. molding cycle. In view of these circumstances, it was therefore decided to

attempt the full-scale production of this new acrylic feeder head for the water filtering units by means of an injection molding process.

The blueprints of the job were turned over to the Firestone Rubber & Latex Products Co., and their engineers knew that the Improved Paper Machinery Corporation was at the moment developing a new and radically different type of injection machine. Their engineers were therefore called into conference and it was decided that satisfactory parts for this highly complicated water filtering unit could be produced on the new machine.

A single cavity mold was designed expressly for this new equipment. After a short period of experimentation, the machine company produced a satisfactory run of the heavy section transparent heads. The reason for this success was attributed by the manufacturer to the fact that the machine permitted a combination of injection and compression molding which incorporated all of the advantages of injection molding, such as absence of fin, speed of production, etc.,

without losing the high pressure on the material that is characteristic of compression molding.

Five of the illustrations accompanying this article clearly describe this combination method of molding. Figure 3 shows an over-all view of the machine with a cutaway section of the mold for the feeder head. Figures 5 and 6 are close-up drawings of this same section of the mold. Figures 7 and 8, on the other hand, show a section at right angles to that pictured in the other three drawings. The mold is pictured from two angles because the section showing the position of the injection nozzle did not coincide with the section showing the highly complicated structure of the part.

The molding operation—step by step

The first step in the molding operation is the placing of removable inserts in position in the open mold. The downward acting toggle clamping unit then operates to close the mold. The over-all drawing of the machine (Fig. 3) shows the unit in this position. In this unit the heater and injection as-

3—An over-all drawing of the new injection machine with a cut-away section showing the mold injection nozzle and the compression piston. 4—Close-up view of the vertically acting ram. This ram permits the machine to transfer mold, and also to combine injection and compression molding. In addition, it serves to cut gates automatically

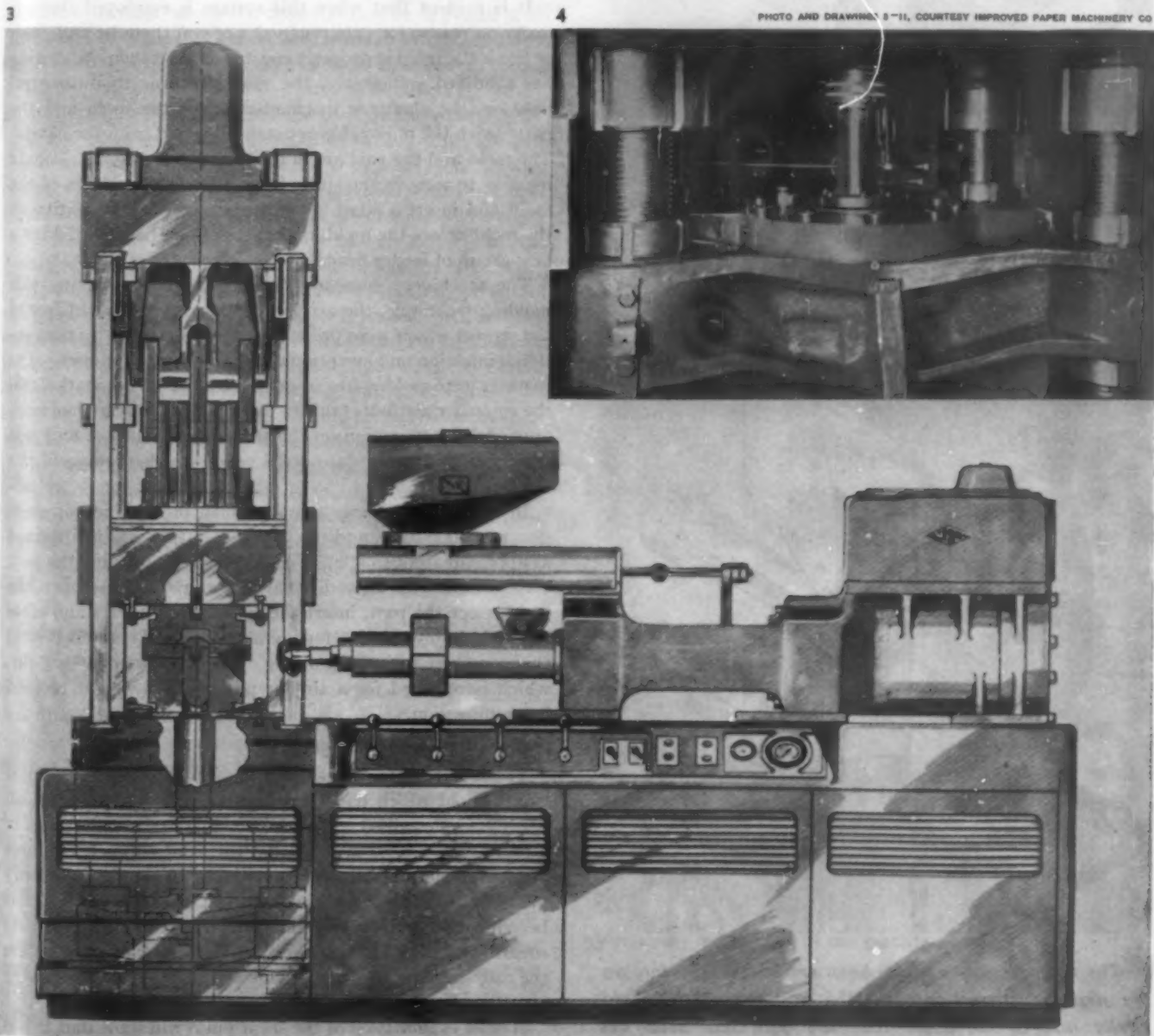
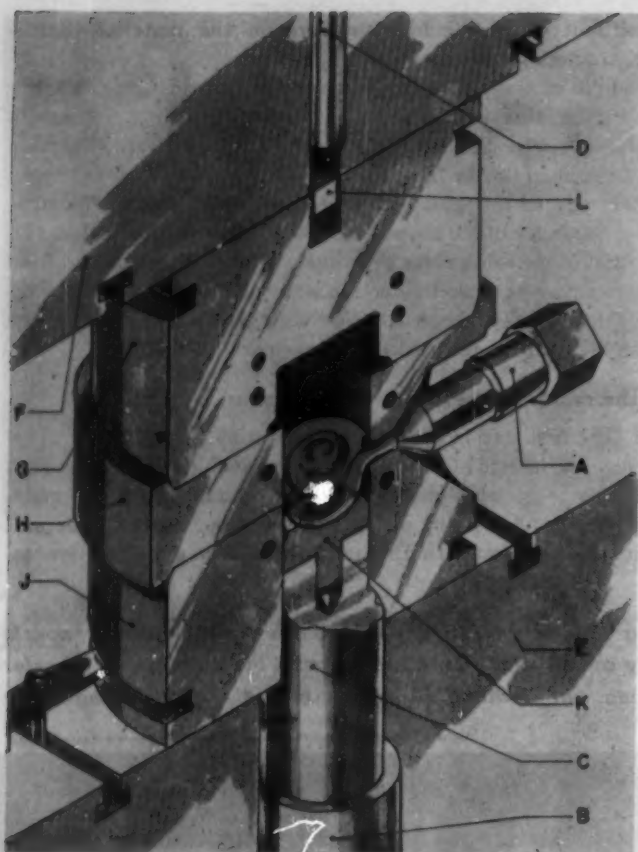
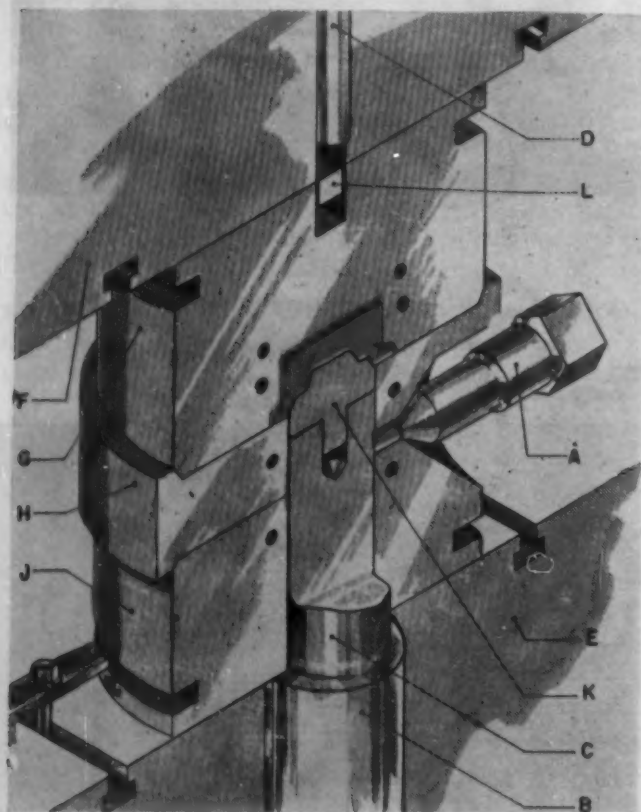


PHOTO AND DRAWING, 3-11, COURTESY IMPROVED PAPER MACHINERY CO.



5—Closeup section of mold for feeder head. Material has been injected into mold cavity but has not filled out mold. Compression ram and part of mold are retracted



6—The compression ram has been raised, thereby forcing the plastic material into all the portions of the mold cavity and at the same time the gate has been cut

sembly is mounted on a bed to permit the entire unit to move horizontally. A small hydraulic ram supplies the motivation for this bed and the pressure required to hold the nozzle tightly against the mold during injection.

After the mold has been closed, the heater and injection assembly is moved forward so that the nozzle contacts the proper portion of the mold. At this point in the sequence of operations, the compression ram (B in Fig. 5) is in the lowered position. Figure 7 also shows this compression piston in the retracted position, but this drawing is of a section at right angles to that shown in Fig. 5. This retarded position of the compression piston permits the injection of a closely controlled amount of material into the cavity under comparatively low pressures. Figures 5 and 7 show the cavity just after the required amount of material has been injected into the mold. At this point, the material is in the form of a curled-up mass of properly plasticized thermoplastic.

Immediately after the injection stroke, the compression ram (B in Fig. 6) moves upward. This motion acts to shear and block off the gate, and to compression mold the part. Figures 6 and 8 show the mold and its components in this final position with the gate sheared and the complicated mold completely filled out with acrylic material under very high pressure.

It is evident that when this system is employed there is really no reason for gate removal, nor can there be any flash or fins if the mold is properly constructed. When the casting has solidified sufficiently, the nozzle returns to its neutral position, the clamping mechanism opens the mold and the part—with the removable inserts—is ejected from the cavity. The mold and the part are in this position in Fig. 9. It only remains to remove the sprue from between the plates of the mold and insert a spare set of inserts in correct position in the mold before the molding operations can be repeated for a new group of feeder heads.

The machinery company claims that by employing this molding technique, the acrylic feed heads are molded free of the strains which were present in parts produced by conventional injection or conventional compression techniques. The castings were molded free from bubbles and shrink marks, and the company attributes this to the fact that pressure had been applied in compression on the whole under surface and was positive at all times during the process of hardening of the molded piece.

In molding this part, actual applied pressure in compression was 3000 p.s.i., and the die temperature was maintained at approximately 150° F. The time cycle in molding the part was 10 min. with an additional minute required to open the mold, eject the part, insert the spare set of inserts and close the mold in preparation for the next cycle. As stated before, this compares with the molding cycle of approximately 1 hr. which is required for a similar piece of less weight molded by compression.

Automatic shearing of gates

The methods of automatically shearing the gate on a single cavity mold which had been injected from the side has already been described. It is also possible to shear the gates of a multi-cavity mold in somewhat the same manner. Figures 10 and 11 picture this process. Figure 10 shows a cut-away view of a die in the closed position just after the material has been injected in the normal manner. The compression or gate shearing ram B is in the lowered or retracted position as are the gate shearing pins, one of which is indicated in the drawing by the letter S.

A close examination of the shear pin S will show that it has

1—The shown Figure same

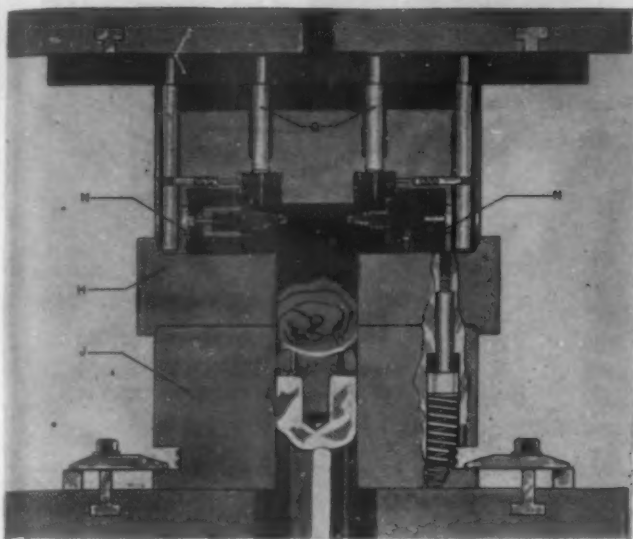
an orifice the run become in the mentati shearing shearing castings the acti friction castings

After the plas gate she the next A slight attached ation to The amount feeder h that incl the surf gates at

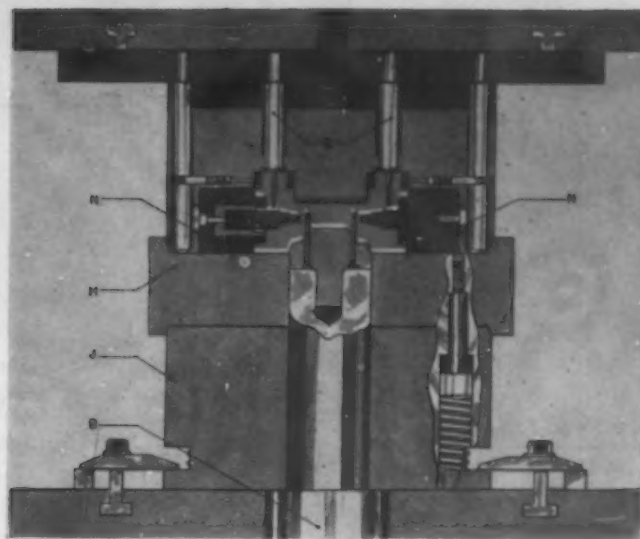
Transfer

This molding that the Sufficien overhead may be mold is multi-ca used to a

In this corporate The open pos (either p chamber.



7—The mold for the acrylic part and the section are both shown at right angles to the position which is shown in Figure 5. The compression ram is retained in the same position as it was in the aforementioned figure



8—Section is the same as it was in Fig. 7, but with the compression ram raised and the mold completely filled out. The section in this and previous figure indicates intricate details and heavy section of this molded part

an orifice through which the material can be delivered from the runner to the cavity. This hole through the pin therefore becomes the gate. After the injection operation has proceeded in the normal manner, and at a time determined by experimentation, ram *B* is raised into the position shown in Fig. 11, shearing the gates. After the required setting time, the gate shearing ram is lowered and the die is opened. The molded castings are then removed from the cavities with the aid or the action of raising ram *B* and the shear pins. The slight friction from the sheared parts of the runners helps to lift the castings from the cavities in the bottom half of the mold.

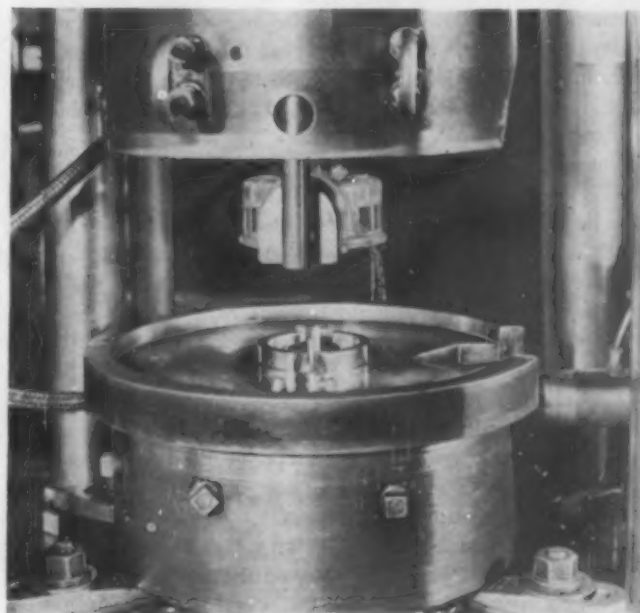
After the molded parts are removed, the sheared portions of the plastic runners are tapped out of the shear pins and the gate shearing ram lowered preparatory to closing the mold for the next cycle. This device is not limited to two cavity molds. A slight change in mold design incorporating knockout bars attached to the gate shearing ram would permit the same operation to be performed on any reasonable number of cavities.

The machinery company claims that a relatively small amount of gate finishing work is required on these acrylic feeder heads. This compares with the finishing operations that include sawing off the runners, sanding and polishing of the surface, which must be done on an article produced with gates attached.

Transfer molding of thermosetting materials

This piece of equipment can also be used for the transfer molding of thermosetting materials. The one stipulation is that the material must be transferred up instead of down. Sufficient positive clamping pressure is available with the overhead toggle clamp so that very high transfer pressures may be used if they are needed. A pressure-type transfer mold is best suited for use in this press, and either single or multi-cavity molds may be used. The upward acting ram is used to actuate the transfer plunger.

In this type of transfer mold, the transfer chamber is incorporated directly in the plate of the lower half of the mold. The operation, therefore, is as follows: With the mold in the open position and the transfer plunger retracted, a preform (either preheated or not) is placed in position in the transfer chamber. The overhead toggles close and clamp the mold.

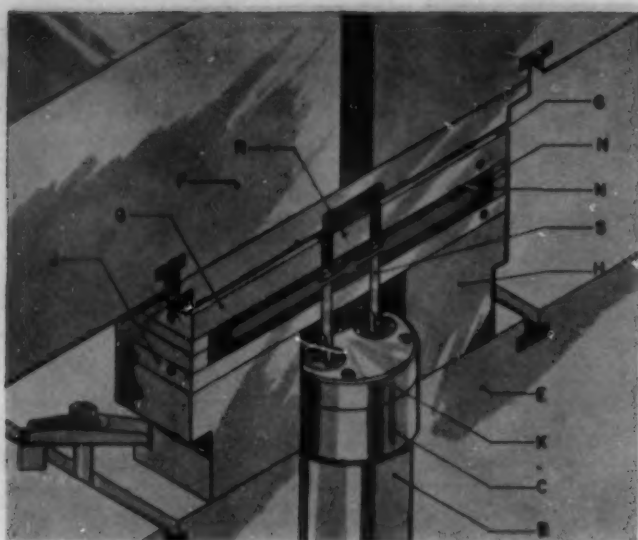


9—After the part has been filled out, the mold is opened and the molded part held in the upper portion of the mold by removable bars. These bars contain threaded plugs which will be manually unscrewed from the molded part after the entire unit has been ejected from the mold

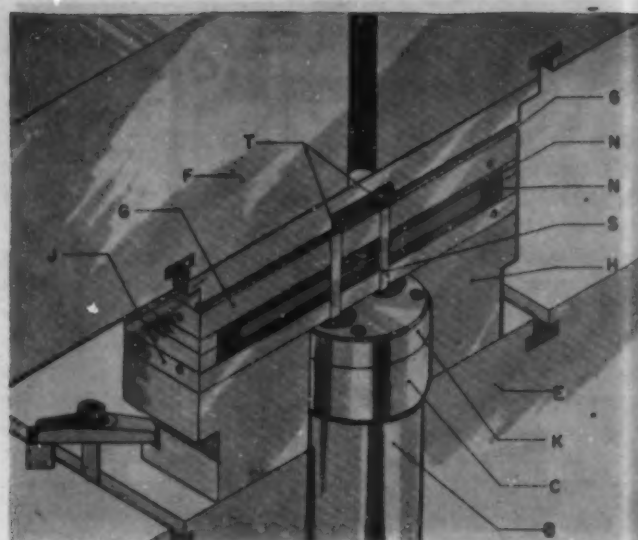
The lower ram then exerts the necessary pressure on the material so that it is transferred from the chamber into the cavities. After the stipulated curing time, the mold is opened and the molded parts, attached to the runners and cull disk, are then removed from the mold cavity—generally in one piece. The entire molding operation is then repeated.

Versatility a keynote of the machine design

It is also quite obvious that this machine can be used for straight compression molding, the toggle supplying the pressure necessary for compression. If upward-acting knockouts



10



11

10 and 11—If more than one cavity is in the mold, the gate cutting is accomplished in a slightly different manner. When the gate shearing ram is in the lowered position, holes in the shear pins line up with the gates of the cavities, permitting the material to pass from the sprue into the cavities. In Fig. 10, the material has just been injected and in Fig. 11, the shearing ram has been raised and the gates cut. Note sheared portions of the gates still in gate shearing pins (T)

are required, the lower ram can be used for this operation. From the foregoing, it is evident that this is a most versatile piece of equipment, handling both thermosetting and thermoplastic materials by many and varied methods and producing a satisfactory output.

There are other unusual features in this machine. For example, the horizontal injection unit provides for interchangeable heating cylinders and rams, is available in capacities up to 22 oz. and is adjustable forward and backward to accommodate molds of various widths. The injection ram on this machine is cored, permitting the use of a coolant—if and when it is considered necessary—in molding certain types of plastic materials.

The clamping unit comprising the clamping mechanism, supporting tension rods and platens, is adjustable as a unit up and down 3 in. each way from a predetermined center line. With this design the machine can accommodate molds having stationary halves of varying thickness. The clamping mechanism is also adjustable up and down to take care of molds of various over-all thicknesses, between the limits of 8 and 14 inches. This mechanism is an improved toggle system, hydraulically operated, and provides a clamping pressure controllable up to 350 tons.

The compression unit provides up to 57 tons pressure in compression. The machine is self-contained and oil hydraulically operated, and is provided with controls for manual or single-cycle automatic operation. Power is supplied by vane-type pumps driven by a 20-hp. motor. The over-all dimensions of the machine are: 10 ft. 4 in. high, 10 ft. 4 in. long and 4 ft. wide. Table I gives a list of additional specifications for this unit.

The advantages of such a machine as this lie in its variety of accomplishments. While it is still a new development, it is not an untried one as the information detailed in the foregoing article proves. Before the machine was finally placed in the hands of the molders, every effort was made to perfect it and it was subjected to a great deal of intensive adjustment and correction. It serves as a splendid example of the rapid strides being made in the production of plastics machinery.

Credits—Material: Plexiglas

TABLE I—MOLDING MACHINE SPECIFICATIONS

Material performance

Rated capacity per molding cycle:

Weight polystyrene.....	8 oz.
Weight methyl methacrylate.....	9 oz.
Weight cellulose acetate.....	10 oz.
Weight ethyl cellulose or cellulose acetate butyrate....	9 oz.
Volume.....	13 cu. in.
Feed hopper capacity.....	50 lb.
Weight of material plasticized per hour.....	60 lb.

Injection specifications

Total pressure on plunger.....	113,000 lb.
Pressure on material, 2.5-in. diam. plunger.....	23,000 p.s.i.
Injection plunger stroke.....	10.5 in.

Die clamping specifications (vertical clamping press)

Method of clamping.....	Hydraulic and toggles (combination)
Total clamping pressure.....	350 tons
Clamping stroke.....	10 in.
Minimum die thickness.....	8 in.
Maximum die thickness.....	14 in.

Platen specifications

Size of platens:

Widths.....	29 $\frac{1}{2}$ by 35 in.
Thickness moving.....	10 $\frac{1}{2}$ in.
Thickness bottom.....	13 in.

Maximum die size between tie rods.....	18 by 23 $\frac{1}{2}$ in.
Knockout provisions.....	Top and bottom

Auxiliary compression ram

Compression pressure.....	50 ton
Diameter of compression piston.....	12 in.
Diameter of compression ram.....	3 in.
Compression stroke.....	6 in.

Power unit specifications

Hydraulic pumps—High volume)

Low volume)

Motor—20 hp., 220/440 v., 60 cycle—3 phase, 1200 r.p.m.

Machine dimensions

Height.....	10 ft. 4 in.
Width.....	4 ft. 0 in.
Length.....	10 ft. 4 in.
Weight.....	11 $\frac{1}{2}$ tons

Tenite poker chips
manufactured by
Amatoy Corporation



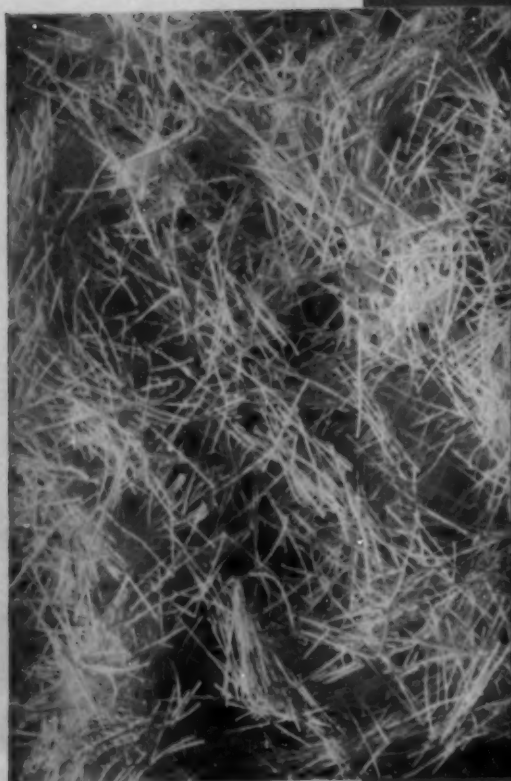
A good bet

Poker chips of Tenite are supplied by the millions to Army PX's. The molded Tenite chip has the square edge which is found on professional type poker chips and is provided with deep serrations on both sides—a special design feature which permits easy stacking and interlocks the chips so that they are not toppled by vibrations.

Prewar, Tenite was a popular material for many game pieces, puzzles, and toys including chessmen, doll heads, miniature boats, toy

soldiers. Postwar, it will again be available in a wide range of colors. Tenite has a beautiful, lustrous surface which is warm and pleasant to the touch. It is molded to finished products at the fastest speeds attained with plastics. For further information about Tenite and its many uses, write to TENNESSEE EASTMAN CORPORATION (Subsidiary of Eastman Kodak Co.), KINGSPORT, TENNESSEE.

Tenite an Eastman plastic



CHOPPED THREAD!

Thermosetting plastics look to fillers for strength. When specifications demand higher impact, greater tensile and compressive resistance, you can depend upon the muscle-building qualities of Claremont fillers.

Claremont cotton flock and chopped thread are uniformly cut to requirements—the longer the cut, the higher the impact strength. These fillers possess a shock resistance of from 3 to 8 times that of woodflour.

As America's largest manufacturer of flock, thread, cord and fabric fillers, Claremont invites the opportunity to "fill in" whenever your plastic material problems require a strong build-up!

CLAREMONT

WASTE MANUFACTURING CO.

CLAREMONT, NEW HAMPSHIRE

The Country's Largest Manufacturer of Flock

V
el

by R. T.

TH
c
plastic
in a h
cedur
paratu
a simi
refrige
taken
at sub
end of
peratu

In g
elonga
the to
plastic
than
The v
peratu

The
13 to
from
peratu
filled,
158°
tures

In
low el
ceptib
as me
ing a
than
tion w

Thi
data
stress
in Re
on the
Refer

Mate

The
terials
All te
406, '4

* Ar
† M

TECHNICAL SECTION

DR. GORDON M. KLINE, Technical Editor

Variation of tensile strength and elongation of plastics with temperature*

by R. T. SCHWARTZ†

THE tensile strength and elongation of a variety of typical filled and unfilled thermosetting and thermoplastic plastic materials were determined at a temperature of 158° F. in a heated room containing the test equipment. This procedure was followed so that both the test specimens and apparatus would be at the test temperature. Data obtained in a similar manner for low temperatures down to -38° F. in a refrigerated room are also included. These latter figures are taken from a previous investigation on mechanical properties at subnormal temperatures (Reference 1, in Bibliography at end of this article) together with additional data at room temperature and -67° F. not reported therein.

In general, it was found that tensile strength decreased and elongation increased with increasing temperature throughout the temperature range investigated. The unfilled thermoplastic materials were very much more affected by temperature than the unfilled or filled thermosetting plastic materials. The variations of tensile strength and elongation with temperature were not linear for any of the materials.

The various unfilled thermoplastic materials decreased from 13 to 100 percent in tensile strength at 158° F. and increased from 58 to 177 percent at -38° F., compared to room temperature. The thermosetting plastic materials, filled and unfilled, decreased from 5 to 38 percent in tensile strength at 158° F. and increased from 5 to 20 percent at low temperatures of -38 and -67° F., as compared to room temperature.

In general, the thermosetting plastic materials exhibited low elongation at room temperature and there was little perceptible change with temperature of elongation at fracture as measured by dividers. The thermoplastic materials having an appreciably higher elongation at room temperature than the thermosetting plastics decreased markedly in elongation with decrease of temperature through the range studied.

This report is a preliminary investigation and stress-strain data were not obtained at high temperatures. However, stress-strain data at room and low temperatures are included in Reference 1. Published data on the effect of temperature on the mechanical properties of plastic materials are given in References 1 to 22 in the Bibliography.

Materials and procedure

The thickness, specific gravity and description of the materials which were all in sheet form are given in Table I. All tests were in accordance with Federal Specification L-P-406, "Plastics, Organic; General Specification (Methods of

Test)," dated Dec. 9, 1942. Type I tensile specimens were used. Elongation in 2 inches immediately before fracture was measured with dividers reading directly in percent, the nearest one-half percent being estimated. The rate of head travel was 0.15 ± 0.01 in. per minute. (Please turn to next page)

TABLE I.—DESCRIPTION OF MATERIALS

Type	Thickness in.	Specific gravity
Fine-weave cotton-fabric phenolic sheet, parallel-laminated; Federal Specification HH-P-256, Type II, Grade L	1/8	1.34
Coarse-weave cotton-fabric phenolic sheet, parallel-laminated; Federal Specification HH-P-256, Type II, Grade C	1/8	1.34
Paper phenolic sheet, parallel-laminated; Federal Specification HH-P-256, Type I, Grade XX	1/8	1.34
High-strength-paper phenolic sheet, cross-laminated	1/8	1.40
Phenolic-resin-impregnated, compressed maple sheet, parallel-laminated; Army Air Forces Specification 15065	1 1/2	1.36
Cast phenol-formaldehyde resin, no filler; transparent amber sheet	5/16	1.36
Molded aniline-formaldehyde resin, unplasticized, no filler; translucent amber sheet	1/8	1.20
Molded aniline-formaldehyde resin, plasticized, no filler; translucent amber sheet	1/8	1.28
Lignin sheet, parallel-laminated	1/8	1.39
Lignin paper sheet, parallel-laminated; paper-base phenolic faces	1/8	1.39
Low-pressure allyl resin		
a. Cast transparent sheet, no filler	1/8	1.31
b. Canvas, cross-laminated sheet	1/8	1.35
c. Glass-fabric, cross-laminated sheet	1/8	1.66
d. Kraft-paper, cross-laminated sheet	1/8	1.38
e. Hurlbut-rag-paper, cross-laminated sheet	1/8	1.38
f. 8-oz. duck, cross-laminated sheet	1/8	1.35
g. Unbleached muslin, cross-laminated sheet	1/8	1.36
Polyvinyl-formal-impregnated, compressed, parallel-laminated birch	1 1/2	1.27
Polymethyl methacrylate, cast transparent sheet; U. S. Army Specification 94-12014-B	1/8	1.18
Cellulose acetate transparent sheet; Army Air Forces Specification 12025-B	1/8	1.28
Polyvinyl chloride acetate transparent sheet	1/8	1.35
Polystyrene molded transparent sheet	1/8	1.05

* Army Air Forces Technical Report, No. 5062, December 11, 1943.

† Materials Laboratory, Army Air Forces, Wright Field.

TABLE II.—VARIATION OF TENSILE STRENGTH AND ELONGATION OF PLASTIC MATERIALS WITH TEMPERATURE*

Material	Temperature ($\pm 2^{\circ}$ F.)	Tensile strength	Elongation in 2-in. gage length at fracture	Change in tensile strength com- pared to 77° F. values
	$^{\circ}$ F.	p.s.i.	percent	percent
Cotton fabric phenolic laminate, Grade L, parallel-laminated	+158	15,000	2	- 9
	+ 77	16,500	2	0
	0	18,600	2	+ 13
	- 38	18,500	2	+ 12
Cotton-fabric phenolic laminate, Grade C, parallel-laminated	+158	14,000	2	- 6
	+ 77	14,900	2	0
	0	17,200	2	+ 15
	- 38	17,700	2	+ 19
Paper phenolic laminate, Grade XX, parallel-laminated	+158	12,600	2	- 26
	+ 77	16,800	2	0
	0	19,400	1	+ 16
	- 38	19,800	1	+ 18
High-strength-paper-base phenolic laminate, cross-laminated	+158	19,100	2	- 24
	+ 77	25,000	1 1/2	0
Phenolic-impregnated compressed maple, parallel-laminated	+158	34,000 ^b	...	- 19
	+ 77	42,000 ^b	...	0
	- 67	44,000 ^b	...	+ 5
Cast phenol-formaldehyde resin, no filler	+158	8,400	1 1/2	- 16
	+ 77	10,000	1	0
	0	11,700	1	+ 12
	- 38	10,400	1	+ 4
Molded aniline-formaldehyde resin, unplasticized, no filler	+158	9,200	2	- 5
	+ 77	9,700	2	0
	- 67	10,500	1 1/2	+ 8
Molded aniline-formaldehyde resin, plasticized, no filler	+158	6,000	6	- 38
	+ 77	9,700	3	0
	- 67	10,900	1	+ 12
Paper-base lignin, parallel-laminated	+158	8,600	1	- 23
	+ 77	11,100	1	0
Paper-base lignin, parallel-laminated; paper phenolic faces	+158	8,700	1	- 27
	+ 77	12,000	1	0
Allyl low-pressure resin				
a. Cast, transparent	+158	3,200	1 1/2	- 14
	+ 77	3,700	1 1/2	0
b. Canvas, cross-laminated	+158	5,100	4	- 35
	+ 77	7,900	3	0
	- 67	9,500	3	+ 20
c. Glass-fabric, cross-laminated	+158	24,900	...	- 10
	+ 77	27,700	3 1/2	0
d. Kraft-paper, cross-laminated	+158	10,700	...	- 21
	+ 77	13,600	4	0
e. Hurlbut-rag-paper, cross-laminated	+158	7,500	...	- 24
	+ 77	9,900	2 1/2	0
Duck, cross-laminated	+158	7,400	...	- 6
	+ 77	7,900	5 1/2	0
Muslin, cross-laminated	+158	6,400	...	- 19
	+ 77	7,700 ^b	3 1/2	0
Polyvinyl-formal-impregnated compressed birch; parallel-laminated	+158	27,300 ^b	...	- 13
	+ 77	31,300 ^b	...	0
Polymethyl methacrylate sheet	+158	4,000	150	- 51
	+ 77	3,100	6	0
	0	13,000	3	+ 61
	- 38	14,500	3	+ 79
Cellulose acetate sheet	+158	3,600	50	- 36
	+ 77	5,600	42	0
	0	10,700	14	+ 91
	- 38	15,500	3	+177
Polyvinyl chloride acetate sheet	+158	Nil (<100)	>50	-100
	+ 77	9,600	35	0
	0	14,300	9	+ 49
	- 38	16,700	4	+ 74
Polystyrene molded sheet	+158	4,200	1	- 13
	+ 77	4,800	1	0
	0	7,100	1	+ 48
	- 38	7,600	1	+ 58

* Values in the table are averages for 3 to 10 specimens. All tests on laminates were made in the lengthwise (strongest) direction.

^b Modulus of rupture in bending.

Templin self-aligning grips were used except in the case of the cast phenolic specimens which were too thick to permit their use. Standard wedge grips were employed for these specimens. To reduce slipping in the grips, coarse emery cloth was used with the rough side against the specimen.

Specimens tested at room temperature were conditioned according to Paragraph A-4 and those tested at low and high temperatures were conditioned for 24 hr. at the test condition according to Paragraph D-1a of Federal Specification L-P-406.

Tests at room temperature were made in the testing laboratory in which the temperature ranged from 75 to 80° F. and the relative humidity from 35 to 50 percent, the specimens being tested immediately after removal from the conditioning atmosphere. Tests at high temperature were made at $158 \pm 2^\circ$ F. and 20 to 30 percent relative humidity. The low temperature tests were at $0 \pm 2^\circ$, $-38 \pm 2^\circ$, and $-67 \pm 2^\circ$ F. The absolute humidity at low temperatures was low but the relative humidity was probably close to 100 percent.

The low temperature tests were made in the refrigerated testing room of the Materials Laboratory and the high temperature tests in the heated testing room. Temperature was measured with a thermometer near the location of the specimen during test. The test specimens and apparatus were, therefore, both at the test temperature and the personnel performing the tests were also in the cold or hot room. Gloves were necessary at high temperature to prevent burning by metal grips and other equipment. At low temperature winter flying clothing and face masks were worn.

Moduli of rupture in bending are reported for the compressed wood materials instead of tensile strength values. Flexure tests were in accordance with Paragraph B-3 of Federal Specification L-P-406. The specimens were $1/4$ in. thick, machined from $1 1/2$ -in. thick panels.

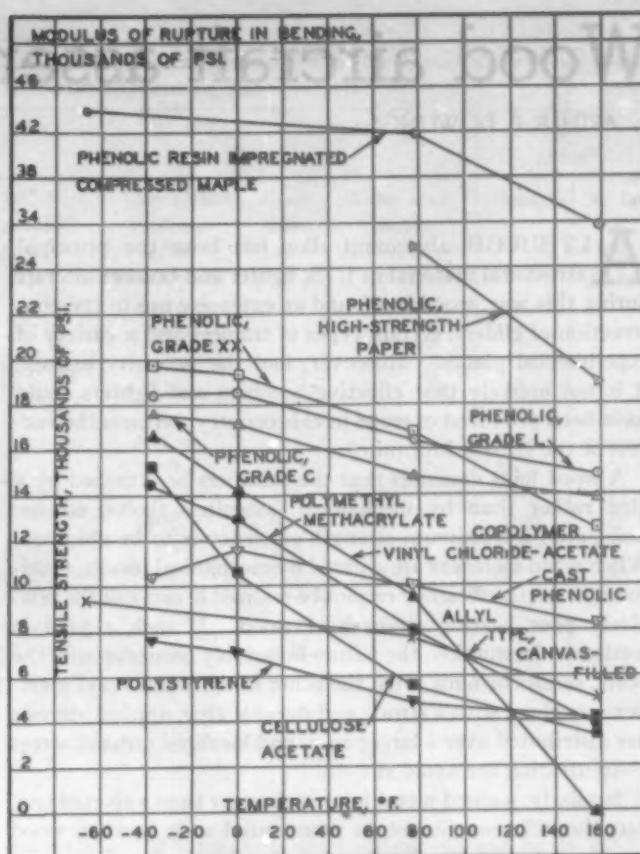
Results and discussion

The results of the tests are given in Table II. Tensile data on typical thermosetting and thermoplastic material are shown graphically in Fig. 1.

Phenolic materials—The percentage drop in tensile strength at 158° F. was considerably higher for paper phenolic laminate than for cotton-fabric phenolic laminate and somewhat higher than for unfilled cast phenolic sheet. The wood-base material, although of low resin content compared to the other laminates, was also more affected than cotton-fabric laminate. The effect of low temperatures was substantially the same for all the materials except the wood-base material, for which there was little increase in strength. Grade L phenolic laminate and cast phenolic materials dropped off slightly in tensile strength from 0 to -38° F., and Grades L and XX laminates showed very little increase. The values were still higher than room temperature values, however.

This may possibly be due to the fact that the thermosetting plastics are very brittle and subject to stress concentration at low temperatures. It is difficult to distribute the stresses uniformly over the cross-sectional area, so that fracture would occur before all the material has been stressed to the probable true tensile strength. The effect was greater for the cast phenolic material which was tested in the standard wedge grips instead of self-aligning grips because of the thickness of the sheet. Some of the cast phenolic specimens failed in the grips at low temperatures but these were not included in the results.

Carswell (Reference 2) reported the tensile strength of unfilled molded phenolic resin to decrease successively at temperatures of -13 and -112° F. compared to 77° F. These tests were made using a molded A.S.T.M. dogbone type speci-



1—Variation of the ultimate strength of a variety of plastic materials with variations in the temperature

men, which is more subject to stress concentration than the type used in this investigation and for the other phenolic molding materials reported in Reference 2. It is also more likely to contain internal strain, as a result of molding. None of the other materials showed this effect.

The same effect to a much smaller degree was shown in the flexural strength tests on this material in Reference 2. Also, Reference 1 shows that the modulus of rupture in bending of unfilled cast phenolic resin and Grade XX phenolic laminate were lower at -38° F. than at room temperature. However, Mehdorn (Reference 17) showed the flexural strength of molded unfilled phenolic resin and of fabric, paper, and wood-base laminates to increase with decrease in temperature from 68° F. to -4 and -76° F. The specimen, materials and test procedures of References 1, 2 and 17 were not exactly comparable, however. Those of Reference 1 and this report were comparable and these data were the only ones which were obtained in a refrigerated room containing the test equipment.

Allyl low-pressure resin—The marked difference between paper and cotton-fabric filled material was not noted when this type of resin was used as the bonding agent. The decreases in strength at high temperature were of the same order of magnitude as for phenolic materials.

Transparent materials used in aircraft enclosures—The tensile strength of the polyvinyl chloride acetate was nil at 158° F. The percentage decrease in strength at 158° F. was greater for polymethyl methacrylate than for cellulose acetate, and greater for the latter than for allyl cast transparent material. However, the actual tensile strengths of all three at 158° F. were not widely different, the methacrylate being the highest. The strength increase and reduction in elongation at low temperatures are very marked. (Please turn to page 194)

Wood aircraft assembly glues

by ARTHUR P. DOWLING*

ALTHOUGH aluminum alloy has been the principal structural material in U. S. fighter and bomber aircraft during this war, wood has found an extensive use in the construction of gliders, certain types of trainers and a variety of experimental planes. Moreover, had the necessity existed, it is not unlikely that effective bombers and fighters could have been produced of wood in this country (witness the success of the British Mosquito).

A wood joint demands that the members be attached by a glue rather than by mechanical fastenings (bolts, screws, nails, etc.) if maximum strength-efficiency is to be obtained. When wood members are secured by mechanical means, maximum strength-efficiency cannot be realized because of the relatively poor bearing strength of wood. If such a joint is loaded to destruction, the failure invariably occurs around the bolts, screws or nails. On the other hand, when wood members are glued with a strong and durable glue, applied stresses are distributed over a larger area, and localized areas of stress concentration are avoided.

Similarly, a glued metal joint is stronger than a riveted one, but the difference is not as pronounced as it is when wood members are involved. Riveted aluminum alloy joints, for example, can be made so that very nearly the yield strength of the metal can be obtained before the rivets fail. Although it is true that a glued metal joint is capable of developing higher strength than a riveted joint, the strength advantage is not always in evidence when the glued joint is subjected to high temperatures or to severe conditions of salt spray. This fact, together with the fabrication difficulties involved in gluing metal, accounts for the limited use of metal glues in aircraft structural members.

Assembly gluing

It is rather difficult to define the term "assembly gluing," but it can be said, in a general way, that an assembly gluing operation is one which involves the gluing of members which are too cumbersome or too irregular in shape to place in a heated press to effect the gluing. Pressure to bring the surfaces together is obtained through the use of clamps, dead weights, or temporary cleats or nail strips. Preferably, and

* Plastics and adhesives section, Naval Air Experimental Station.

most often, the glue used for assembly gluing operations is capable of setting at normal room temperatures.

Thus it will be appreciated that a considerable difference exists between assembly glues and glues which are used for fabricating flat or curved plywood which has a high degree of durability. The heat that can be employed in the latter molding operations makes possible the use of high-durability glues such as the phenolics or the melamines. It has been a problem (and one which has been solved only recently) to carry out assembly gluing at room temperatures and obtain a glued joint which has a degree of durability comparable with that obtained by high-temperature gluing.

With the advent of the rubber-bag molding technique, many of the more optimistic envisioned a completely molded wood airplane in which no assembly gluing would be necessary. While this technique does minimize the amount of assembly gluing needed, a certain amount is still required; that which is necessary, as often as not, involves critical attachments vital to the performance of the airplane.

Casein glue

Prior to the war casein glue was the principal assembly glue used in this country, and this type is still widely used by British aircraft manufacturers. Casein is a protein and therefore has the characteristics which might be expected of it, such as relatively poor water resistance and susceptibility to attack by organisms. But while these points of vulnerability can be readily demonstrated in the laboratory, well-formulated casein glues have had an annoying penchant for performing well in service. A possible explanation for this seeming paradox is the fact that extreme precautions have always been used to protect casein glue joints in the airplane by keeping the joints coated with a paint or varnish. It is a fact that casein glue joints which are unprotected will display relatively poor weather resistance in comparison with certain of the resin glues. The poor weathering resistance will be manifest by a steady deterioration in the strength of the joints which have been glued.

Despite its obvious disadvantages, casein glue is still the only assembly glue which will function at any temperature which might prevail in the shop. It will even set at tempera-

TABLE I.—EXAGGERATED EFFECT OF VARYING pH GLUES ON THE TENSILE STRENGTH OF WOOD^{a,b,c}

Wood	Solution of resin glue used for impregnation	pH of resin-catalyst mixture	Resin in wood percent	Ultimate tensile strength			
				Test 1	Test 2	Test 3	Test 4
1/8-in. spruce	None	...	0	11,000	7,970	9,400	11,700
1/8-in. spruce	Urea	3.5	23-28	9,400	10,120	10,000	10,800
1/8-in. spruce	Alkaline phenolic	8.5	23-28	12,200	9,400	10,500	10,000
1/8-in. spruce	Acid phenolic	1.4	23-28	9,800	7,780	10,300	10,000
1/16-in. birch	None	...	0	11,000	7,340	12,000	13,300
1/16-in. birch	Urea	3.5	23-28	11,100	8,890	11,700	10,900
1/16-in. birch	Alkaline phenolic	8.5	23-28	11,600	8,050	10,200	10,900
1/16-in. birch	Acid phenolic	1.4	23-28	9,700	7,130	8,600	9,700

^a Data from N.A.E.S. report TED. No. NAM 2583, Part V.

^b 20 tensile specimens having a reduced neck at center; grain parallel to direction of pull.

^c Test conditions:

1. Broken immediately (after curing and drying) at 12 percent moisture content.
2. Roof exposure (Philadelphia) for 1 year.
3. 10-day cycle—24 hr. 100 percent r. h., 100° F.; 24 hr. at 105° F.
4. 10 days continuous heat at 105° F.

TABLE II.—TYPICAL STRENGTH VALUES OF ASSEMBLY-GLUED WOOD JOINTS* (INCLUDING DATA ON THE EFFECT OF NAVY AERO SPEC. G-33 HEATING AND SOAKING CYCLE ON DIFFERENT GLUES OF VARYING pH)

Type of glue	Tensile shear ^b						pH		Compressive shear ^c	
	Initial		After 48 hr. soaking in water at 75° F.		After 180° F. heating and soaking cycle		Glue film (approx.)	Water used in heating and soaking cycle (after test)	Strength	At 75° F. Wood failure
	Strength	Wood failure	Strength	Wood failure	Strength	Wood failure				
	p.s.i.	percent	p.s.i.	percent	p.s.i.	percent	percent		p.s.i.	percent
Casein	412	17	161	0	0	0	0	12	3120	76
Acid phenolic	489	100	595	90	371	100	76 ^d	1.4	3477	77
Alkaline phenolic	538	75	591	88	581	89	108	8	2990	50
Alkaline phenolic	515	92	433	100	350	100	68 ^d	9.8	2940	40
Resorcinol	511	92	548	100	496	100	97	7.1	3077	86
Resorcinol and acid	406	46	...	...	246	89	61 ^d	1.7	...	...
Urea	459	66	419	37	0	0	0	3.6	3048	88
Veneer alone	...	...	...	...	...	...	...	4.3	...	...

* Data abstracted from N.A.E.S. Report TED. No. NAM 2583, Part IV.

^b Riehle type specimen; 3-ply 1/8-in. birch; 20 specimens.

^c Maple block shear test.

^d Evident catalytic damage to the wood.

^e Strength after cycle
Initial strength × 100.

tures near freezing. Unlike the synthetics, which set by chemical reaction, casein glue sets largely by the dissipation of its water of solution into the wood and surrounding atmosphere. This action is relatively independent of the prevailing temperature.

Urea resin glues

The urea-formaldehyde resin glues were the first synthetics capable of setting (polymerizing) at normal room temperatures. Although the available urea glues differ widely in formulation, all depend upon the same principle for setting, i.e., the susceptibility of a urea resin (with its full complement of combined formaldehyde) to acids or acid-forming salts. The action of the latter substances upon the resin effects a polymerization at room temperature. Capital is made of this phenomenon by harnessing the reaction so that it will occur in the glue joint, by applying the liquid solution of resin and acid-salt to the wood surfaces to be glued, placing the assembly under pressure at room temperature, and allowing the setting of the resin glue to occur.

Investigations into the physical properties of urea resin glues have revealed the fact that the acidic catalysts which are used for accomplishing polymerization may have an adverse effect upon the aging characteristics of the glue. To control this factor, the degree of permissible acidity has been standardized in all Army and Navy specifications relating to urea glues. All present specifications require that the glue shall not have a pH lower than 2.5. It may be said that the higher the pH of urea glues (other factors being equal), the better will be the durability of the glued joint.

Phenolic assembly glues

Some time after the development of the urea assembly glues, phenolic assembly glues became available. Like the urea type, the first of the phenolic assembly glues required the use of acidic substances for catalyzing the polymerization. But unlike the urea type, the phenolics required much stronger acids and an elevated temperature (140 to 160° F.)

for setting. Whereas urea glues will set in 4 to 6 hr. at 75° F. at a pH of 2.5 or over, the acid-phenolics have required a pH of 1 to 1.5 to set in the same interval at 140 to 160° F.

While certain of the acid-phenolics possessed much better resistance to adverse conditions of heat and moisture (simultaneous) than either the casein or urea type glues, conservative elements in the gluing field have looked with disfavor upon their use because of their high acidity, and the possible adverse effects of this acidity upon the strength of the wood. Probably a more deterring factor accounting for the somewhat limited use of the acid-phenolics has been the fact that cumbersome heating arrangements are needed to supply the heat necessary for curing the glue. In addition, the application of heat to a wood assembly may disturb the moisture content of the wood (unless external moisture is added to compensate for the heat) and may increase the possibility of warpage and cracking occurring in the glued assembly when the wood assumes its normal moisture content in storage or in service.

A later development in phenolic assembly glues has been the alkaline-catalyzed type. This type also requires an elevated temperature if curing is to be accomplished in a practical length of time. However, since the pH of the new type is near the neutral point, the factor of attack on the wood does not have to be reckoned with, and its use has become more widespread than the acid-phenolic variety. Although the alkaline-phenolics suffer from the same practical difficulties which faced the acid-phenolics (heating the assembly to be glued), they do yield glue joints having excellent durability characteristics and their development marked a departure from the conventionalized thinking which has seemed to characterize researchers concerned with the phenolic assembly glue problem.

Resorcinol assembly glues

The most recent development in aircraft assembly glues is the resorcinol type. These glues are derived from resorcinol and formaldehyde, and appear to have the durability characteristics inherent in the phenolic family of condensates, plus

TABLE III.—MAPLE BLOCK SHEAR STRENGTH^{a,b} (NORMAL AND ABNORMAL GLUE LINE THICKNESS)

Type of assembly glue	Casting characteristics	Normal glue thickness				¹ / ₃₂ -in. glue thickness			
		Initial shear test		Shear test after heating cycle ^c		Initial shear test		Shear test after heating cycle ^c	
		Strength	Wood failure	Strength	Wood failure	Strength	Wood failure	Strength	Wood failure
		p.s.i.	percent	p.s.i.	percent	p.s.i.	percent	p.s.i.	percent
Resorcinol	Cracks due to shrinkage	3040	78	3000	67	3020	68	2760	47
Alkaline phenolic	Cracks due to shrinkage	3202	21	3739	68	3123	39	2712	7
Acid phenolic	Perfect casting	3477	77	3607	86	3111	62	2873	63
Urea	Cracks and crazes	3045	88	3522	67	2805	88	1300	0
Casein	Porous honeycombed	3003	53	3117	36	1406	0	0	0

^a Data abstracted from N.A.E.S. Report TED. No. NAM 2583, Part VI.^b Conventional maple blocks shear test except that shear area was 1.5 sq. in.^c Heating cycle: 9 days of 12 hr. at 160-170° F. and 12 hr. at 75° F.

the practicable working characteristics of the urea assembly glues. The resorcinol type assembly glue consists of two parts—a water-soluble liquid resin and a separate component (usually a powder) which is added to the resin prior to use. The two components are neutral in pH, have excellent stability in storage and yield a glue which has approximately the same working and setting characteristics as the urea resin type. Like the ureas, the resorcinol glues remain water soluble during their working life (2 to 4 hr. at 75° F.) and this characteristic is of practical advantage in cleaning brushes, rolls and other gluing paraphernalia.

It has been stated that casein glue will yield joints having good durability if the joints are protected with a varnish or a paint. The uncertain conditions which prevail in service by no means assure that such protective coatings will remain in an efficient state. Since the wood aircraft structure largely depends upon the glue which is used in its fabrication, it is hazardous to depend, in effect, upon a paint system to keep the airplane together. Therefore, in the interest of high-quality standards, assembly glues are evaluated in glued wood specimens which are unvarnished or unpainted.

This point is raised because objections are sometimes en-

countered when glue tests are conducted upon unprotected specimens, on the basis that the airplane will be painted in actual use and that the glue lines will be protected in consequence thereof. Painting of test specimens prior to subjecting to durability tests not only conceals that which it is desirable to ascertain (the relative durability of the glue) but injects a complicating variable which leads to endless tests, i.e., which paint or varnish is to be used for protection.

Testing of wood glues

Despite the fact that there has been a considerable amount of work devoted to the testing of wood glues, an accurate and rapid laboratory test for quantitatively evaluating glue durability is non-existent. Tests such as those involving boiling water or severe heating and soaking cycles form a basis for separating the distinctly inferior from the distinctly superior glues, but the fact that a given glue does not meet the requirements established for such tests cannot be construed as a positive indication that the glue might not have adequate durability in use. The best that can be done, particularly in specifications, is to utilize a test which, if anything, is overly severe and to establish require- (Please turn to page 192)

TABLE IV.—SUMMARY OF CHARACTERISTICS OF VARIOUS TYPICAL ASSEMBLY GLUES

	Casein	Urea	Alkaline phenolic	Acid phenolic	Resorcinol
Stability in storage at 75° F., mo.	6+	6+	2-4	1-2	6+
Water solubility when mixed	O.K.	O.K.	O.K.	Not soluble	O.K.
Working life at 75° F. when mixed, hr.	5	2-3	3-6	3-6	2-3
Safe assembly interval (open—75° F.), min.	15-20	15-20	30-60	30-60	15-20
Preferable curing temperature, ° F.	60° or over	70° or over	150°-180°	140°-160°	75° or over
Safe clamping interval, ^a hr.	4-8	4-8	4-6	4-6	4-6
Odor	Not objectionable	Not objectionable	Not objectionable	Not objectionable	Slight
Dermatitis characteristics	None	Slight	Slight	Pronounced	Slight
Principal advantages	Relative independence of shop temperatures	Practical working characteristics	High durability; long assembly time	Long assembly time; high strength of the glue in a mass	High durability; practical working characteristics
Principal disadvantages	Lack of water and mold resistance	Susceptibility to sustained dry or moist heat	Curing temperature needed	Acidity; water insolubility when mixed; instability in storage; and curing temperature needed	Relatively high cost

^a Will vary with the type of construction being glued; time interval relates to the preferable curing temperature.

A Hairbreadth Idea . . . Molded in PLASTICS



Another Plastic Success Story

This section of an aircraft timing device was a production headache before it was brought to TECH-ART. Even with a mold already built, production was threatened with delays because of the extreme accuracy required. Tolerances had to be $\pm .002$ inch, $-.001$ inch . . . any deviation could result in a time lag that would throw instrument calculations off as much as 1300 feet. Working with the original mold, TECH-ART engineers first made the necessary refinements to insure precision tolerances. Then TECH-ART mold builders built a duplicate mold for use on an automatic compression machine. A non-warping plastic material completed the specifications for a precision product. Operating both molds, the increased production soon made up all previous delays, and full delivery of accurate pieces was made on time.

TECHNICAL NOTES—The material selected for this piece possesses a low expansion characteristic plus high resistance to warpage, to insure hair-line clearances and perfect mechanical operation through a wide range of temperatures encountered in flight.

Whenever split-hair tolerances turn a simple design into a complex production problem, the solution can usually be traced to one of four molding factors — sound product engineering . . . precision-built molds . . . full knowledge of the most suitable plastic material for the job . . . and adequate production facilities to turn out the finished plastic product in the time specified. This is the combination that serves your product at TECH-ART, where precision products are custom-engineered and custom-built by skilled engineers and master mold builders who regularly insure that each new product will be another Plastic Success Story by TECH-ART.

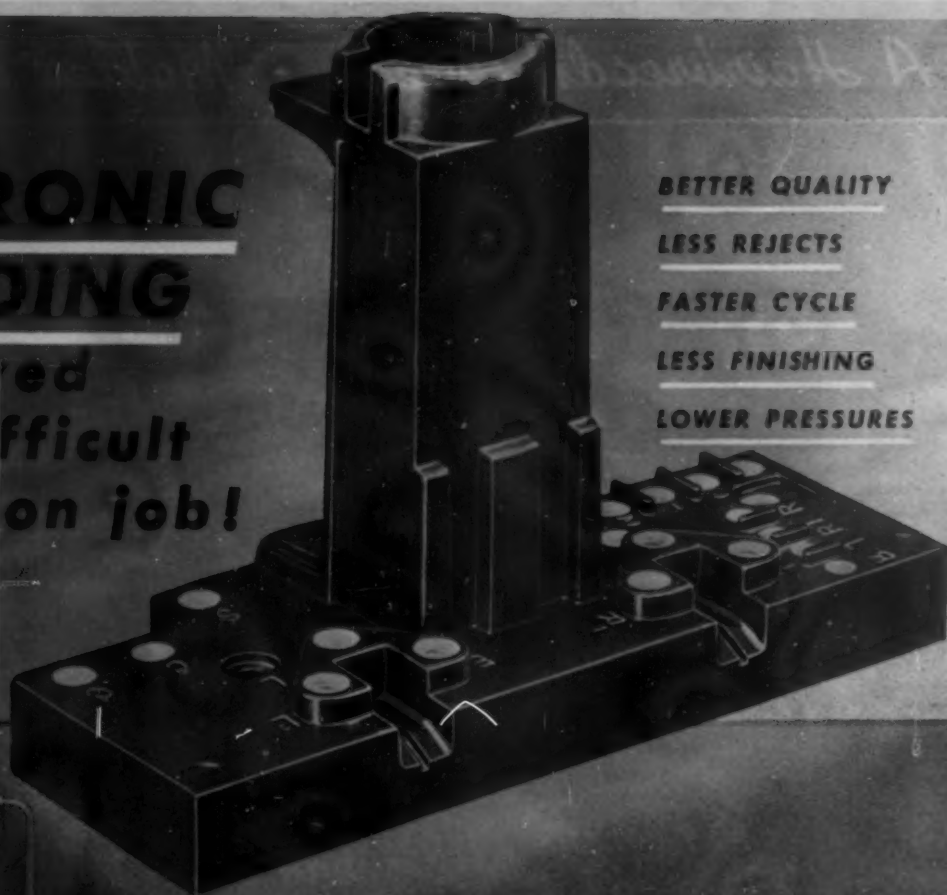


36th Ave. and 41st Street • LONG ISLAND CITY, N. Y. • Tel. AStoria 8-6050-1
SUCCESSORS TO BOONTON RUBBER MANUFACTURING COMPANY
PIONEER PLASTIC MOLDERS . . . Established 1891

TECH-ART
PLASTICS COMPANY

ELECTRONIC MOLDING

**solved
this difficult
production job!**



BETTER QUALITY

LESS REJECTS

FASTER CYCLE

LESS FINISHING

LOWER PRESSURES

Federal Telephone and Radio Corporation molds this intricate telephone connector block with a 50-ton H-P-M Electronic Molding Press equipped with 12-1/2 ton downward acting hydraulic transfer ram. A two cavity die is employed. Preformed molding material (Bakelite 9176) is preheated in a Megatherm high frequency heater. Press cycle time is 1-1/2 minutes. Each part has 21 metal inserts. Parts are molded with high gloss finish, free from flash.

Prior to the installation of the H-P-M Electronic Press, these connector blocks were molded by the conventional transfer method. Quality was inferior due to flash around inserts and costly finishing operations were required. Rejects were high.

Choose H-P-M Electronic Molding Presses for your difficult molding jobs. Although they are designed specifically for use with your high frequency heating equipment, they are of universal design, and can be efficiently used for conventional compression molding. Write today, stating your requirements.

THE HYDRAULIC PRESS MFG. CO.

Mount Giload, Ohio, U. S. A.

Branch Offices in New York, Philadelphia, Cleveland, Detroit and Chicago. Representatives in principal cities.



**All-Hydraulic PLASTICS
MOLDING MACHINES**

Injection • Compression • Electronic

REVOLUTIONIZING PRODUCTION WITH HYDRAULICS SINCE 1877

CAL
Plastic
plastic
trailer
tions a
ing, vi
curtain
tics fo
table t
for wa
for har
acetate

WH
RESIN
COTT
Report
treatm
eral p
terial.
coating
ments,
age, lu

WH
STYR
1945).
styrene
ble for
war era
on how
made a
cess pl
ble. It
will be
cents a

PLA
WOOD
Nichol
(Dec. 2
as a
for th
produc
gested
constit
living t
luloses,
penes,
wood i
cussed.
velopm
wood.
new bi
ing te
new u
substanc
Thirty-

THE
ERPR
H. T.
47-9 (1

PLASTICS DIGEST

This digest includes each month the more important articles of interest to those who make or use plastics. Mail request for periodicals directly to publishers.

General

CARAVANS UP TO DATE. Brit. Plastics 17, 193-4 (May 1945). The use of plastics in the construction of motor car trailers is discussed. Suggested applications are resin-bonded plywood for paneling, vinyl plastics for floor coverings and curtains, acrylic or cellulose acetate plastics for windows, laminates for paneling, table tops and cupboards, acrylic plastic for washbasins, cellulose acetate or casein for hardware, and polystyrene or cellulose acetate for lampshades.

WHAT WE MAY EXPECT FROM RESINS IN THE TREATMENT OF COTTON. D. H. Powers. Am. Dyestuff Reporter 34, 191-3 (May 7, 1945). The treatment of cotton with resin offers several possibilities for improving the material. The topics considered are strength, coatings, suitings, blankets, outer garments, industrial fabrics, washables, tentage, luster and finishes.

WHAT PRICE POST-WAR POLYSTYRENE? Chem. Ind. 56, 954-5 (June 1945). The effect of the large capacity for styrene production which may be available for making styrene plastics in the post-war era is discussed. The answer depends on how much synthetic rubber will be made and what will be done with the excess plant capacity which will be available. It is estimated that styrene monomer will be available at approximately 10 cents a pound.

PLASTICS FROM WOOD AND FOR WOOD IMPROVEMENT. R. V. V. Nicholls. Paper Trade J. 119, 43-6 (Dec. 21, 1944). Wood has been recognized as a potential source of raw materials for the manufacture of plastics and products of a similar nature. It is suggested that the technical uses of wood constituents parallel their function in the living tree. The role of cellulose, hemicelluloses, lignin, tannins, resins and terpenes, fatty acids and sterols, and finally wood itself in the plastics industry is discussed. Attention is focused on the development and potentialities of improved wood. The introduction of impregnation, new binders, and new forming and molding techniques has resulted in many new uses for this product as well as a substantial improvement in quality. Thirty-three references.

THE DEVELOPMENT OF WEATHERPROOF SOLID FIBER BOARD. H. T. Barker. Paper Trade J. 120, 47-9 (Mar. 22, 1945). A brief survey of

the development of weatherproof solid fiber board is traced. Typical V boards are described and sizing specifications for their paper components are given. The two most extensively used weatherproof adhesives, starch-urea-formaldehyde resin and polyvinyl alcohol extended with an asphalt emulsion, are discussed and their preparation briefly described.

LIGNIN—AN ECONOMIC LIABILITY OR A CHEMICAL ASSET. H. F. Lewis. Chem. Eng. News 23, 1074-80 (June 25, 1945). The sources, processing, properties and utilization of lignin are discussed.

Materials

CASHEW NUT SHELL LIQUID RESINS. J. D. Morgan. Brit. Plastics 17, 152-4 (April 1945), 225-7 (May 1945). Cashew nut shell liquid consists mainly of two phenols, about 10 percent cardol and 90 percent anacardic acid. Cardol is a substituted resorcinol, and anacardic acid is a derivative of salicylic acid. Anacardic acid is decarboxylated readily by heat to give a monohydric phenol known as anacardol. These may be converted by appropriate steps to a brown viscous liquid which will react at room temperatures with paraformaldehyde or furfural to give a resin. The mixture may be trowelled on prior to setting and therefore has wide application as stopping and filling compounds. The brown viscous liquid will also react with hexamine to give a soft rubbery material. The shell oil reacts directly with aldehydes to give hard, infusible, flexible resins. They are used as impregnating insulating varnishes, wire enamels, concrete primers, laboratory furniture finishes and bottle cap liners. The resin may be combined with phenolic molding compounds to improve flow and alkali resistance. Many useful chemicals may be made from the cashew nut shell oil.

SILICONE RESINS AND PLASTICS. W. S. Penn. Plastics (London) 9, 273-9 (June 1945). This is a comprehensive review article concerning the preparation, the properties and the applications of the silicone resins.

LIGNITE: SOURCE OF LOW-COST HIGH-DIELECTRIC RESINS. A. D. Sinning. Plastics 2, 70-2, 128-9 (June 1945). A description is given of a new series of phenolic-like resins developed from the phenols produced in the low temperature carbonization of lignite and other subbituminous coals found in great abundance throughout the Middle West and Northwest areas of the United States and Can-

ada. The resins are comparable to the regular phenolics in their tensile strength, water absorption, flexural and compressive strengths, but with a superior dielectric strength and arcing resistance. Possible applications are suggested.

NEWER STARCHES FOR PAPER COATING. C. C. Kesler and E. T. Hjemstad. Paper Trade J. 120 56-8 April 19, 1945). A new starch-urea resin reaction product was developed which possesses several desirable characteristics which are not found in the ordinary varieties of starch. Varying degrees of water resistance may be developed upon proper treatment, adhesiveness is increased, tendency to retrograde is inhibited and the amount of free water apparently decreased. The product has been used successfully as a binder in clay paper coatings. Increased water resistance is obtained.

ETHERS AND ETHER-ESTERS OF LAC AND THEIR POLYMERIZATION. II. B. S. Gidvani and N. R. Kamath. London Shellac Research Bur., Tech. Paper No. 23, 24 pp. (1944). The polymers of the ethers and ether-esters of lac were investigated. The products are recommended as plasticizers for coatings. They may also be used in cellulose lacquers.

INCREASED PRODUCTION OF WALNUT SHELL FLOUR IS ASSURED BY NEW PROCESS. Pacific Plastics 3, 20-2 (June 1945). The production of walnut shell flour is briefly described.

POLYSTYRENE. S. Booth. Brit. Plastics 17, 130-5, 172-80 and 200-6 (Mar., April and May 1945). This is a review of the information available concerning polystyrene. Part I is concerned with the synthesis and polymerization of styrene. Fifty references. Part II is concerned with the structure and properties of polystyrene. Thirty-two references. Part III is concerned with the molding, extruding, casting, machining and plasticizing of polystyrene. Eight references.

Molding and fabricating

LOW-PRESSURE LAMINATING. J. D. Nelson. Paper Trade J. 120 33-6 (Jan. 4, 1945). The low-pressure laminating technique is being used in the fabrication of irregularly shaped products where the high-pressure method cannot be readily adapted. Although the products made using low pressures do not have the characteristics of those made using high

pressures, by correct combination of resin, filler, process modification, etc., a product can be made which is satisfactory for many purposes. There is a fairly wide choice of techniques which can be used but the hydraulic membrane or rubber bag process is the most popular. In this, the molds can be made of such low strength materials as sheet metal, wood concrete, plaster of Paris, etc. The strength properties of the low-pressure laminates compare favorably with the high-pressure laminates for most uses and have additional advantages which are favorable to its continued development.

THE PREPARATION AND APPLICATIONS OF PULP-RESIN PREFORMS. R. H. Mosher, N. N. T. Samaras and L. M. Debing. *Paper Trade J.* 120, 48-52 (Mar. 15, 1945). Pulp-resin preforms produce molded pieces which possess high physical strength properties and good surface characteristics and chemical resistance. When pulp-resin preforms are molded, very little flow of the fiber and resin is necessary as the material is uniformly distributed throughout the mold. Since relatively low pressures are required, either solid dies or flexible rubber bag molding units can be used. The preforms are prepared by breaking up the pulp in a beater, forming the preform in a vacuum or pressure felting unit, and drying out the water in a circulating air oven. The resin can be incorporated either by dispersion in the beater so that the pulp and resin are preformed together, or by felting the pulp preform and then incorporating the resin by an impregnation operation. The resins utilized in the process can be either thermosetting or thermoplastic in nature. In general, however, phenolic or melamine thermosetting resins are used because they produce moldings which are stable over the temperature range of -60° to 150°C. and are highly resistant to chemical action. The physical strength properties of the molded pieces depend upon the type of fiber as well as the type and method of incorporation of the resin. Pulp preforms can be used in the field of small moldings where a large number of pieces of the same dimensions which required high physical strengths are necessary. The big field of the future is visualized in the production of medium and large pieces which cannot be economically molded using present day materials. Here the physical strength properties are a necessity and the good appearance is a definite advantage. Twenty references.

Applications

NEW ADHESIVES FOR BUILT-UP ASSEMBLIES. G. G. Havens and G. Gordon. *Product Eng.* 16, 289-93 (May 1945). A group of adhesives (Metlbond) for bonding metals, textiles, plastics, woods and rubbers is discussed. The bonding techniques are described. Data on the

shear, tensile, fatigue, peel and impact strengths, creep, gasoline resistance and results of service tests are reported. Data on the effect of thickness of the adhesive layer and temperature on the strength properties are also given.

SYNTHETIC MOUNTING MEDIUM OF HIGH REFRACTIVE INDEX. W. D. Fleming. *J. R. Micr. Soc.* 63, 34-7 (Mar. to June 1943). The synthesis of a resin with a refractive index of 1.7 to 1.8 is described. The resin is suggested for mounting diatoms and other specimens.

ELASTIC PLASTICS—TODAY AND TOMORROW. J. P. Kelso. *Automotive & Aviation Ind.* 92, 18-21 (Mar. 1, 1945). Some applications of nonrigid vinyl plastics are described. These include distributor cap nipples, grommets, valve caps, seals for holes, vibration dampers and shock absorbers. The specifications for 10 vinyl chloride acetate molding compositions are given.

IMPROVED WOOD. T. D. Perry. *Canadian Chem. & Process Ind.* 29, 3-8 (Jan. 1945). Three methods for improving wood are described. One consists of bonding layers of wood together with resins. Examples of this type are plywood and laminated timbers. Another consists of combining layers of wood with cloth, paper, metal, plastics and rubber. The third consists of impregnating the wood with resins under pressure. All these procedures are used to improve the stability and strength properties. Resin adhesives, techniques, properties are given.

SHRINKAGE CONTROL OF WOOL. A. D. Nute. *Am. Dyestuff Reporter* 34, 167-70, 176 (April 23, 1945). Various methods for controlling the shrinkage of wool are reviewed. The use of melamine-formaldehyde resin for this purpose is discussed in detail. Principles of application and the properties of the treated wool are described.

PRESENT AND PROPOSED USES OF PLASTICS IN THE MOTION-PICTURE INDUSTRY. B. H. Thompson. *J. Soc. Motion Picture Engrs.* 43, 106-114 (1944). A general discussion.

SOME APPLICATIONS OF PULP AND PAPER IN THE PLASTICS INDUSTRY. D. T. Jackson. *Paper Trade J.* 120 25-30 (June 28, 1945). The applications of pulp and paper in plastics can be divided into three main divisions: the fiber is used as a raw material and is converted by chemical action into a thermoplastic material, e.g., cellulose acetate; the fiber is mixed with or used in the form of paper as a filler; or, the paper is coated or impregnated to confer special properties required for packaging, etc. The manufacture of laminated products is discussed covering such subjects as the paper used, the treating and conversion.

Coatings

EMULSION PAINTS. J. W. Church. *Paint Ind. Mag.* 60, 51-3, *Official Digest Federation Paint & Varnish Production Clubs No. 243*, 69-76 (1945). The preparation, properties and applications of emulsion paints are reviewed. The principles of emulsion paint formulation are as follows: 1) the binder must be essentially of the oleoresinous type; 2) the ratio of binder to pigment by volume must be of the same order as the ratio used in formulating a flat wall paint of the same quality to be matched; 3) the pigment must be dispersed in the binder in the oil phase; 4) the paint should preferably be in the oil phase at the time it reaches the consumer; 5) the paint shall be stable over long periods of time under the climatic conditions to be experienced; and 6) the paint should be shipped in as concentrated form as possible to permit the addition of a maximum amount of water in the field.

INSTRUMENT FOR MEASURING THICKNESS OF NONCONDUCTING FILMS APPLIED OVER NONMAGNETIC METALS. A. L. Alexander, P. King and J. E. Dinger. *Ind. Eng. Chem. Anal. Ed.* 17, 389-93 (June 1945). An instrument is described for measuring the thickness of coatings containing metallic and nonmetallic pigments.

POLYPENTAERYTHRITOL VARNISHES. H. Burrell and C. J. Vander Valk. *Paint, Oil Chem. Rev.* 107, No. 25, 14-20, 33 (1944). The synthesis and properties of varnishes made from pentaerythritol are described.

RESIN BAKING FINISHES — A MODERN TOOL OF THE PAINT MAKER. H. Greenwood. *Paint Varnish Production Mgr.* 25, No. 3, 64-8 (1945). Phenol-formaldehyde resins in the B stage dissolved in alcohols are used successfully as coating materials for metal surfaces. The surfaces must be clean and rough. Isopropyl alcohol is preferred because of its low surface tension. The coating may be applied by dipping, roller coating, spraying, slushing and brushing. The coating is baked at 275°F. for 60 min. or at 500°F. for 1 minute. Multiple coatings are recommended. The coating should not exceed 1 mil in thickness. The finishes have excellent resistance to acids, organic solvents, abrasion and weathering. The electrical properties are also good. The coatings are not particularly flexible.

RADIO WIRING INSULATION. W. J. Tucker and J. V. Wredde. *Plastics (London)* 9, 284-7 (June 1945). Various plastics used as insulation on wire are discussed for tropical application. It is concluded that insulation of the polyvinyl chloride type is more suitable for tropical use than insulations containing cellulose or varnishes.

TECHNICAL BRIEFS

Abstracts of articles on plastics in the world's scientific and engineering literature relating to properties and testing methods, or indicating significant trends and developments.

Engineering

CHEMICALS FOR PHENOLIC AND UREA RESINS. G. D. Bieber. *Chem. & Met. Eng.* 52, 104-5 (June 1945). The phenomenal growth in production of phenolic and urea resins has generated a large demand for chemicals. Approximately 33,000 short tons of phenol, cresols, cresylic acid, xylenols, formaldehyde, fillers and hexamethylenetetramine were consumed in the manufacture of phenolic resins in 1933 while 3000 short tons of urea, formaldehyde, fillers and curing agents were required in the production of urea resins in the same year. About 138,000 short tons of raw materials were required for phenolic resins and 45,000 short tons for urea resins in 1943. These figures represent a 318 percent increase for phenolic resins and a 1390 percent gain for urea resins. About 83 percent of the 1,016,000 short tons of these chemicals consumed in resin manufacture from 1933 to 1943 was used in the manufacture of tar-acid resins, while the remainder was consumed in the production of urea resins.

VACUUM DRYING APPARATUS FOR UNSTABLE POLYMERIC MATERIALS. A. R. Kemp and W. G. Straitiff. *Ind. Eng. Chem. Anal. Ed.* 17, 387-9 (June 1945). A vacuum apparatus for drying unstable high polymers is described.

TEXTILE FIBER FROM CASEIN: FACTORS AFFECTING THE TENSILE STRENGTH. R. F. Peterson, T. P. Caldwell, N. J. Hipp, R. Hellbach and R. W. Jackson. *Ind. Eng. Chem.* 37, 492-6 (May 1945). Studies on the preparation of fibers from acid-precipitated casein with a laboratory spinning machine are reported. Dissolving the casein, spinning, stretching and hardening are the major operations of fiber production. A spinning solution containing 20% protein and having a pH of 9.2 was employed in most of the experiments. All fibers were given a final hardening treatment with formaldehyde. Stretching the tow issuing from the spinnerette, either in the precipitating bath or between godet wheels in air, gave a tensile strength of about 0.7 gm. per denier. Under these conditions of stretching, the addition of aluminum sulfate to the precipitating bath containing sulfuric acid and sodium sulfate did not affect the strength of the fiber. However, such incorporation of aluminum sulfate had a marked effect in

subsequent operations involving simultaneous stretching and partial hardening with formaldehyde. When the latter process was operated at 85° C., a dry strength of 1 gm. per denier and a wet strength of 0.5 gm. per denier were obtained. Comparative measurements of tensile strength of artificial protein fibers which will be exposed to moisture are best made after the fibers have been swollen in water and dried.

HOT-SPRAY METHOD OF COATING PAPER WITH PLASTIC MATERIAL. N. N. Murty. *Plastics (London)* 9, 288-92 (June 1945). A machine for applying thermoplastic materials to paper by a hot-spray technique is described. No solvents are used in the method which is described.

FIBERS AND CHEMICALS USED IN PRESENT DAY FABRICS. H. W. Wilkinson, Jr. *Paper Trade J.* 120, 37-8 (May 24, 1945). Many natural and synthetic resins, dyes and pigments are used to finish textiles. The problem of removing these finishes from scrap textile materials prior to their use in paper-making is difficult and complex. The permanent type of water repellent finishes may be removed by digesting with weak formic acid. The non-permanent types which are usually metallic salts in wax may be removed by treating with oxalic acid followed by washing with a soap-solvent emulsion. The poor colors may be removed by water and the intermediate colors by an alkaline solution. The best grade of colors can not be removed. Research is needed to find methods of removing finishes based on the vinyl resins and synthetic rubbers.

ELECTRONICS PROVIDES NEW TOOLS FOR CHEMICAL INDUSTRY. *Chem. Ind.* 56, 956-9 (June 1945). Electronic tools for the chemical industry are reviewed. These include the mass spectrometer, microwave spectrometer, electronic power conversion equipment, fluorescent lighting, control apparatus and ion bombardment equipment.

Chemistry

VISCOSITY AND MOLECULAR WEIGHT. III. THE HETEROGENEITY COEFFICIENT. S. Coppick. *Paper Trade J.* 119, 36-42 (Dec. 28, 1944). Wood pulps are known to be very heterogeneous as regards both the species and chain length of the component polysaccharides. This nonuniformity leads to di-

vergence from both the theoretical and empirical relationships between viscosity, concentration and infinite dilution functions which appear to be valid for more uniform preparations. This adds further complications to viscometric methods for the determination of the average molecular weight of commercial wood pulp cellulose. The divergence was followed during sulfate pulping. The results indicate that the distribution of chain length changes during pulping in such a manner as to give viscosity relationships similar to those obtained for blends of a number of pulps. These results confirm the "equalizing" effect of pulping which has been reported by others. Since most commercial pulps may be considered as blends of various proportions of raw and well cooked fibers, these factors are always present and cannot be neglected in the interpretation of viscosity data. The results indicate that the relationship between viscosity, concentration and molecular weight must contain a "heterogeneity coefficient." This quantity is worked out for various degrees of sulfate pulping, and the data indicates that its value is unity solely for well blended, thoroughly cooked or purified pulps. However, with raw cooks the "heterogeneity coefficient" increases to such an extent as to make viscosity interpretations very inaccurate if the heterogeneity effect is neglected.

THE FORMATION OF VINYL POLYMERS IN EMULSIONS AND IN SUSPENSIONS. S. Siggia, W. P. Hohenstein and H. Mark. *India Rubber World* 111, 436-41 (Jan. 1945). The polymerization of styrene in agitated emulsions was studied. Particular attention is given to the amount of polymer formation during a specific time period, the average degree of polymerization of the polymer and the average particle size of the emulsion at any specified time.

Properties

ABRASION RESISTANCE OF PAPER BASE PLASTICS AND ASSOCIATED MATERIALS. E. R. Hoffman. *Paper Trade J.* 120, 45-8 (Jan. 25, 1945). For measuring one type of abrasion resistance the Taber abraser is a convenient research tool and the wear-rates obtained by the loss-in-weight method provide a reasonable comparison between associated materials. Reproducible results are obtained when a definite procedure is followed and certain precautions are taken, such as, giving the specimen an initial

run, periodic weighings and periodic resurfacing of the abrading wheels. The abrasion resistance of paper base plastics as determined by the Taber abraser can be summarized as follows: 1) The abrasion resistance of thermosetting laminates can generally be classified as better than wood and pressed boards, and comparable to the softer metals, aluminum and copper. 2) Paper base laminates made with commercial phenolic resins vary in abrasion resistance, but it appears that the abrasion resistance of the resins can be improved by the use of additional agents to such a degree that the wear-rate of the laminate is independent of the paper base. 3) In general, rag paper and bleached sulfite paper base laminates have good abrasion resistance and are better than unbleached sulfite paper base laminates (except as noted in 2). 4) The abrasion resistance of paper base laminates decreases as the number of impregnated sheets per panel increases up to a certain point and then remains constant. 5) Fiber orientation affects the abrasion resistance of the laminates. 6) The abrasion resistance of laminates is unaffected by moisture up to about 75 percent relative humidity but decreases rapidly at higher humidities. 7) The abrasion resistance of laminates does not vary with resin contents between 35 percent and 48 percent or with sheet thickness up to 6 mils.

DIMENSIONAL STABILITY OF PLASTICS. R. Burns. A.S.T.M. Bulletin No. 134, 27-30 (May 1945). The various types of dimensional change are reviewed. Data are reported illustrating the effects of humidity, drying and cycling procedures on the dimensions of several types of plastics. Dimensional stability depends on the manufacturing processes, the materials and conditions under which the test is run.

FLEXURAL PROPERTIES OF PLASTICS. W. A. Zinzow. A.S.T.M. Bulletin No. 134, 31-7 (May 1945). The results obtained in a series of flexural tests in five different laboratories are summarized. It was found that the effect of varying the loading edge radii is negligible. The rate of loading has a considerable effect on the flexural strength and little effect on the modulus of elasticity. Variation in the span-depth ratio below twelve has an appreciable effect on the test results.

DIELECTRIC LOSSES IN NON-POLAR POLYMERS. A. P. Votinov, P. P. Kobeko and G. P. Mikhailov. J. Tech. Phys. (U. S. S. R.) 14, 18-23 (1945); Chem. Abstracts 39, 1569 (April 10, 1945). The dielectric losses of the polymers and copolymers of styrene, vinyl naphthalene, phenylbutadiene and butadiene are extremely small (tangent loss angle about 10^{-4}). The losses are independent of

temperature up to the softening range where they increase. Nonpolar plasticizers do not affect the loss angle; polar plasticizers cause an increase to a relaxation maximum at a temperature in the region of high elasticity.

DIELECTRIC LOSSES IN POLAR POLYMERS. P. P. Kobeko, G. P. Mikhailov and Z. I. Novika. J. Tech. Phys. (U. S. S. R.) 14, 24-8 (1944); Chem. Abstracts 39, 1569 (April 10, 1945). The dielectric losses of the polymers of vinyl acetate, vinyl chloride, methyl methacrylate, vinylfuran and methyl vinyl ketone are higher than those of nonpolar polymers (tangent of loss angle about 10^{-2}). Copolymers of polar and nonpolar compounds have dielectric losses comparable with those of the polar polymers. Two maxima in the tangent of the loss angle-temperature curve are observed. The upper one corresponds to a relaxation in the region of high elasticity; the lower one is of a structural nature and is attributed to noncompact packing of the molecule.

CALENDER GRAIN IN POLY-VINYL CHLORIDE. G. De Simone. Materie plastiche 9, 41-3 (1943); India-Rubber J. 107, 669-70 (1944). The effect of calender grain on the properties of plasticized polyvinyl chloride was studied. The extensibility was less and the tensile strength greater in the direction of the calender grain. Since the same effect was observed for compositions plasticized with various compounds, the effect must be caused by the polyvinyl chloride and not the plasticizer. The effect is attributed to alignment of the large polyvinyl chloride molecules parallel to the calender grain. In bending tests, cracking appeared at about the same number of flexes regardless of the direction of grain. However, the number of flexes from the initial cracking to complete break was less for those specimens which were tested across the grain.

THE WATER REPELLENCY OF TEXTILE FABRICS. H. Wakeham, W. B. Strickland and E. L. Skau. Am. Dyestuff Reporter 34, 178-82 (April 23, 1945). The resistance of a fabric to penetration by water depends not only on the twist of the yarn and the closeness of weave, but also on whether the surface is easy or hard to wet. Wettability depends upon the chemical and physical properties of the fibers and those of the substances with which the fibers are contaminated or with which the yarns or fabrics are finished. From a consideration of the physico-chemical principles of wetting, the contact angle between the water and the fabric is found to be of great significance with regard to water-repellent behavior of the fabric. The tensiometric test for determining contact angle permits an evaluation of the fabric finish independently of the weave construction. The contact

angles determined on a number of samples correlated well with the usual spray-test ratings and with hydrostatic pressure and Gurley densometer air permeability values when these were compared in the light of the properties they measure and of the characteristics of the fabrics tested. Seventeen references on the subject are given in this article.

Testing

SOME APPLICATIONS OF ULTRASONICS IN HIGH-POLYMER RESEARCH. H. Mark. J. Acoust. Soc. Am. 16, 183-7 (1945). This is a review. Ultrasonic waves of 100 to 1000 microns can produce or destroy colloidal suspension, break van der Waals bonds or destroy primary chemical bonds. The temporary decrease in the viscosity of gelatin in water and rubber in toluene when subjected to ultrasonic waves illustrates the breaking of van der Waals forces. The permanent decrease in the viscosity of solutions of polystyrene, cellulose nitrate and polyvinyl acetate when subjected to ultrasonic waves illustrates the destruction of primary valence bonds.

AN AUTOMATIC HEAT DISTORTION RECORDER FOR PLASTICS. G. A. Heirholzer and R. F. Boyer. A.S.T.M. Bulletin No. 134, 37-41 (May 1945). The construction and operation of an automatic heat distortion recorder for plastics is described.

CONSTANT-LOAD TESTS ACHIEVED ELECTRONICALLY. R. J. Demartini. Textile World 95, 115-17, 186 (Mar. 1945). An electronic control which makes it possible to perform constant-rate-of-load tests with a pendulum-type testing machine is described.

DETERMINING THE FLAMMABILITY OF THERMOSETTING MATERIALS. J. A. Gale, R. W. Stewart and J. B. Alfors. Plastics 2, 56, 58-60, 126 (June 1945). Apparatus and methods are described to test the flame resistance of thermosetting plastics. Data are presented for ignition time, burning time, ignitions temperature and change in flexural strength on burning.

A HIGH TEMPERATURE, HIGH PRESSURE RHEOMETER FOR PLASTICS. H. K. Nason. J. Applied Phys. 16, 338-43 (June 1945). A modified Bingham-type rheometer designed for operation at temperatures up to 500° F. and at pressures up to 2000 p.s.i. is described. Interchangeable orifice plates permit wide variation of shear conditions. With this instrument, flow properties may be studied under conditions approximating those encountered in the actual processing of thermoplastics, e.g., by molding or extrusion. The non-Newtonian nature of most commercial plastic materials makes it impossible to obtain a reliable concep-

tion of their rheological behavior by testing at a single fixed temperature, shearing force or rate of shear, and renders comparisons based on such arbitrarily defined conditions extremely hazardous. Each material must be studied over a range of test conditions and the entire flow curve must be evaluated, before reliable conclusions can be drawn. This is especially true since some materials show rapid changes in consistency in certain narrow but critical temperature ranges while other materials change only gradually and show no such critical regions. The present instrument is especially useful for detecting and evaluating such effects. Typical results are presented for cellulose acetate, polystyrene and polyvinyl resin plastics, and correlation with practical experience is pointed out. The instrument is slow, and this limits the amount of its usefulness for persons other than those who are research investigators.

YOUNG'S MODULUS OF ELASTICITY OF FIBERS AND FILMS BY SOUND-VELOCITY MEASUREMENTS. J. W. Ballou and S. Silverman. *J. Acoust. Soc. Amer.* 16, 113-19 (Oct. 1944). A method is described for determining the modulus of elasticity of natural and synthetic fibers and films from sound velocity and density. Results are reported.

THE APPLICATION OF INFRARED SPECTRA TO CHEMICAL PROBLEMS. *Trans. Faraday Soc.* 41, 171-297 (April and May 1945). This issue is devoted to a general discussion of recent advances in the application of infrared spectroscopic methods to the analysis of molecular structure.

IDENTIFICATION OF MELAMINE AND UREA RESINS IN WET STRENGTH PAPER. R. W. Stafford, W. M. Thomas, E. F. Williams and N. T. Woodberry. *Paper Trade J.* 120, 51-6 (April 19, 1945). The details of two new laboratory methods for the identification of melamine and urea resins in wet strength paper are reported. The first procedure involves a dye-staining test for melamine, which in some cases is also applicable to urea resins and proteins. The second procedure describes an optical method for the specific identification of urea after hydrolysis of the resin and precipitation with xanthidrol. Reported procedures for the detection and identification of protein wet strength additives as well as general methods for resins in paper are listed and discussed.

THE EFFECT OF WIDTH AND SPAN-DEPTH RATIO ON THE FLEXURAL STRENGTH OF LAMINATED PLASTICS. E. M. Schoenborn, G. R. Proctor and J. Carvajal. *A.S.T.M. Bulletin* 134, 42-7 (May 1945). A study was made to determine the effect of different test variables on the modulus of rupture

and modulus of elasticity in an effort to develop better testing techniques and to gain a more intimate knowledge of their significance. The results obtained from over 500 flexural tests are reported. Laminated phenolic sheet, grades X and C, and vulcanized bone fibre sheet were tested at span-depth ratios of 8, 12, 16 and 24 to 1 and in widths varying from $\frac{1}{4}$ to 1 inch. Specimens were cut both lengthwise and crosswise from $\frac{1}{4}$ and $\frac{1}{2}$ in. sheet stock. Nearly all tests were remarkably consistent, calculated values of flexural strength and modulus exhibiting average deviations within ± 3 percent of the mean of 5 to 10 determinations. In general, calculated maximum fiber stress at rupture was found to decrease, and the modulus to increase, with increasing span-depth ratio. The effect of width of specimen appeared anomalous, particularly for the phenolic materials, since samples cut lengthwise showed increasing strength, while those cut crosswise gave decreasing values, as the sample width increased. Both the flexural strength and modulus calculated for the fiber were independent of width over the range covered. Only two thicknesses of sheet were included in this investigation so that no general statements regarding the effect of specimen depth can be made. Several correlations of the observed data were made which show that the formulas currently being used to calculate ultimate flexural stress and modulus of elasticity are not rigorous for the materials studied. A plot of breaking load versus specimen dimension indicates that the load is a power function of the dimension, the exact function being dependent upon the nature and direction of the material.

Synthetic rubber

DETERMINATION OF UNSATURATION IN BUTYL RUBBER. J. Rehner and P. Gray. *Ind. Eng. Chem. Anal. Ed.* 17, 367-70 (June 1945). A procedure is described for determining the unsaturation in Butyl rubber. The method is based on the reaction of the polymer, in solution, with ozone to give degraded species, the limiting viscosity of which is governed by the original unsaturation. Some relevant information is given on the effects of concentration and molecular weight on the viscosity of the polymer solution, the stability of the ozonized solution and the effects of certain addition agents. Unsaturation values based on this method and on one involving reaction with iodine chloride are correlated for Butyl rubbers which are found to contain a number of diolefin units.

THE ROLE OF ORGANIC PEROXIDES IN THE PROCESSING OF RUBBER. W. B. Warden. *India Rubber World* 111, 309-11, 317 (Dec. 1944) and 432-5 (Jan. 1945). The principal commercial applications of organic peroxides

are discussed. These include vulcanization or curing of natural rubber and some of the synthetic rubber-like materials, fluidification, plasticization and reclaiming. Some of the newer organic peroxides have certain definite advantages over the more common benzoyl peroxide for use in rubber. Some physical data are presented on stearyl peroxide, the most logical of the newer peroxides for such applications. It is cheap, can be easily and apparently safely handled and compounded, and contains no undesirable adulterants. The curing times and physical properties of an alkyd resin synthetic rubber-like material, Paraplex X-100, are essentially the same when cured at 260° F. with stearyl peroxide or with the benzoyl peroxide dispersion. The theories of the oxido-fluidification of rubber are discussed and it is concluded that the breaking of secondary cohesive forces between the rubber macromolecules as a supplementing factor to oxido-scission of chemical bonds is a prominent factor in the mechanism. The advantages and cost of stearyl peroxide makes the idea of partial oxido-plasticization worth considering. A considerable saving in time and power for milling can also be effected by the use of this method. Seventy references on the subject are given.

DIELECTRIC DISPERSION AND ABSORPTION IN NEOPRENE GUM AND TREAD STOCKS. W. C. Schneider, W. C. Carter, M. Magat and C. P. Smyth. *J. A. C. S.* 67, 959-63 (June 1945). The dielectric constants and dielectric losses of neoprene-GN gum and tread were measured at 20, 40 and 60°C. over a frequency range in certain cases from 60 cycles to 3000 mc. The Kirkwood-Fuoss theory of dielectric relaxation was verified over a wide frequency region. By use of this theory the dipole moment per monomer unit for Neoprene-GN gum was found to be 1.99D. Experimental evidence was found to confirm the assumption that there is only slight, if any, interaction between carbon black and neoprene. The free energies of activation and relaxation times were determined for neoprene gum. From the free energy of activation it was calculated that there are 17 carbon atoms in the relaxing units. The energy of activation and entropy of activation for neoprene gum were found to be 14.3 kcal. and 23.6 e. u., respectively. The distribution in the entropy of activation arising from the distribution in free energy of activation was found to be 17.0 e. u., which indicates that most of the entropy of activation arises from the distribution in free energy of activation. The frequency variation of the dielectric loss of neoprene tread is explained by use of the Maxwell-Wagner theory of dielectric relaxation. The high value of the dielectric constant, 6.45, at 3000 mc. indicates another dispersion region at higher frequencies.

U. S. Plastics Patents

Copies of these patents are available from the U.S. Patent Office, Washington, D. C., at 10 cents each.

COATING. O. Carmichael (to I. F. Laucks, Inc.). U.S. 2,375,195, May 8. A thermosetting adhesive in aqueous suspension containing finely divided particles of the reaction product of blood albumen and a phenol, and sufficient alkali to give a pH of 7 to 10.

MOLDING APPARATUS. G. B. Sayre (to Boonton Molding Co.). U.S. 2,375,252, May 8. A molding apparatus comprising a powder measurer, a pill press and a molding press.

POLYMERIZATION CONTROL. F. J. Soday (to United Gas Improvement Co.). U.S. 2,375,256, May 8. Resinous polymers are prepared in the liquid phase with application of heat. As the polymer forms it falls by gravity from several points through a heating zone in finely divided form until the desired degree of reaction has been attained, at which point it is cooled and collected.

PLASTIC SPRING. T. Friedman. U.S. 2,375,357, May 8. A spiral spring molded from thermoplastic material.

PLASTIC MATERIAL. A. M. Howald and L. S. Meyer (to Libbey-Owens-Ford Glass Co.). U.S. 2,376,365, May 8. A resinous body of great compressive strength comprising a layer of cellulosic fabric impregnated with a solution of urea-formaldehyde containing an acidic catalyst which, when dried and cured, retains 60 percent cured resin.

CLOSURE. M. Knight, R. W. Wampler and W. J. Arner (to Libbey-Owens-Ford Glass Co.). U.S. 2,375,369, May 8. A transparent closure comprising a sheet of laminated safety glass including two sheets of glass and an interposed layer of plastic, one glass sheet having high heat-absorbing properties and the other having high light and radiant energy transmission.

GASKET. J. D. Ryan (to Libbey-Owens-Ford Glass Co.). U.S. 2,375,388, May 8. A thermoplastic gasket for use in the closure of a container, comprising polyvinyl acetal, plasticizer and filler.

PLASTIC SHEET. G. B. Watkins (to Libbey-Owens-Ford Glass Co.). U.S. 2,375,396, May 8. Plastic sheet, for safety glass lamination, formed of polyvinyl acetal and plasticized with dibutyl sebacate is coated temporarily with powdered sugar to facilitate handling.

IMPREGNATION PROCESS. M. Croce (to Certain-Teed Products Corp.). U.S. 2,375,403, May 8. A method for impregnating a felted web with a material in the thermoplastic class.

TRICHLOROACETONITRILE. R. T. Foster (to Imperial Chemical Industries Ltd.). U.S. 2,375,545, May 8. In the process of preparing trichloroacetonitrile and its polymers, the reaction mixture of chlorine and acetonitrile is passed over an active carbon catalyst which has been impregnated with a halide of a metal.

POLYMERS. G. J. Leuck (to Corn Products Refining Co.). U.S. 2,375,564, May 8. Dextrose is polymerized by heating in the absence of water and in the presence of boric anhydride or tetra, meta or orthoboric acid.

PLASTIC. G. D. Martin (to Monsanto Chemical Co.). U.S. 2,375,572, May 8. A new composition obtained by heating a copolymer of butadiene and acrylic nitrile with crude tolyl dichlor phosphine until the evolution of hydrochloric acid has been completed.

ABRASIVE. L. K. Rimer (to James H. Rhodes and Co.). U.S. 2,375,585, May 8. An abrasive pad is prepared by extruding filaments of a plastic substance, dispersing an abrasive substance throughout, compressing the mass into a web, cutting the web into sheets, folding the sheets, and finally sealing the cut edges to provide tubular pads.

SCREEN MATERIAL. H. W. Thomas. U.S. 2,375,597, May 8. A screen fabric composed of thermoplastic monofilaments produced by weaving the monofilaments into a screen, tensioning the screen, heating while under tension, cooling and allowing the monofilaments to set while they are still in crimped condition.

ROSIN POLYMER. E. A. Bried (to Hercules Powder Co.). U.S. 2,375,618, May 8. The melting point of a rosin is raised by polymerizing in the presence of an organic sulfonic acid and acetic acid and finally removing the acids.

CHLORINATED HYDROCARBONS. F. M. Clark (to General Electric Co.). U.S. 2,375,623, May 8. Solid adhesive compositions are prepared from a mixture of decachlor diphenyl benzene and chlorinated diphenyl.

INSULATING MATERIAL. F. M. Clark (to General Electric Co.). U.S. 2,375,624, May 8. An electrical insulating material comprising crystalline chlorinated diphenyl benzene and chlorinated diphenyl oxide.

CONTAINER. S. Gordon. U.S. 2,375,645, May 8. A plastic two-part container for a dental plate.

CONDENSATES. L. C. Jones and W. P. Ericks (to American Cyanamid Co.). U.S. 2,375,659, May 8. Condensation products of alkoxypropylamines with alkylol cyanamides.

LACQUER. T. R. Smith (to Maytag Co.). U.S. 2,375,701, May 8. A lacquer comprising polystyrene dissolved in equal parts of 2-nitropropane, acetylene tetrachloride, toluene and butyl ethylene glycol ether acetate.

PLASTIC. J. S. Tinsley (to Hercules Powder Co.). U.S. 2,375,708, May 8. A plastic composition comprising ethyl cellulose stabilized with a mono-ether of hydroquinone.

COATING. I. C. Clare (to Hercules Powder Co.). U.S. 2,375,753, May 15. A coating comprising a solvent and a resin produced by reacting a polyhydric alcohol with the polymeric residue left by distilling polymerized rosin.

ABRASIVES. A. Saunders and L. S. Engle (to Interchemical Corp.). U.S. 2,375,823-4-5, May 15. Non-thermoplastic resinous finishes are polished with an aqueous suspension of calcium silicate, calcium oxide and silicon dioxide, or the same materials dispersed in formamid or a polyhydric alcohol.

EXTRUSION. C. E. Slaughter (to Extruded Plastics, Inc.). U.S. 2,375,827, May 15. Warping is prevented during extrusion of an elongated rodlike thermoplastic section by cooling after extrusion, reheating briefly on the cooling of a short section and heating similar portions successively in a straight-line operation.

CELLULOSE DERIVATIVES. C. Coolidge and J. S. Reese, IV (to E. I. du Pont de Nemours and Co., Inc.). U.S. 2,375,838, May 15. Insoluble cellulose derivatives are prepared by reacting a cellulose derivative containing free hydroxyl groups with a crystalline monomeric polyalkoxymethyl melamine.

CELLULOSE DERIVATIVE. R. C. Houtz (to E. I. du Pont de Nemours and Co., Inc.). U.S. 2,375,847, May 15. Cellulose, alkali cellulose or partial cellulose ethers are reacted with acrylonitrile in the presence of water and an inorganic alkaline catalyst.

YARNS. P. W. Morgan (to E. I. du Pont de Nemours and Co., Inc.). U.S. 2,375,864, May 15. Cellulose acetate yarns are crinkled by heating to 60°C in an aqueous solution of the mono butyl ether of ethylene glycol.

CHLORINATED RUBBER. W. H. Stevenson (to Hercules Powder Co.). U.S. 2,375,958, May 15. Rubber dissolved in a rubber solvent is chlorinated to a 60% chlorine content and a viscosity of 7000 centipoises in toluene at 25°C.

LIGHT POLARIZER. A. Thomas (to Polaroid Corp.). U.S. 2,375,963, May 15. Light polarizing material is prepared by staining with an iodine solution a molecularly oriented baked sheet of a linear polyvinyl oxy compound.

RESINS. V. H. Turkington and W. H. Butler (to Bakelite Corp.). U.S. 2,375,964, May 15. Oil-soluble resins of high melting point are prepared from tar acids by separating the acids into fractions and reacting with formaldehyde in the presence of acidic catalysts and previously reacted fractions which have lower reactivity.

COATING. J. D. De Vine. U.S. 2,375,978, May 15. A film-forming or coating composition formed of the reaction product of zein and furfural, nitrocellulose, ethyleneglycol monoethyl ether, butyl alcohol, ethyleneglycol monobutyl ether and a plasticizer.

ORGANO-SILICON POLYMERS. R. R. McGregor and E. Leathen (to Corning Glass Works). U.S. 2,375,998, May 15. A polymeric organosilicon oxide having one organic radical per silicon atom, the organic substituents being alkyl radicals or phenyl radicals and a small amount of boric oxide.

POLYMERS. W. L. Semon and C. F. Fryling (to B. F. Goodrich Co.). U.S. 2,376,014, May 15. In the process of polymerizing butadiene with another material, the addition of an aliphatic diazo compound takes place.

POLYMERS. W. L. Semon (to B. F. Goodrich Co.). U.S. 2,376,015, May 15. In the process of polymerizing an olefinic compound, an aliphatic substituted triazine is added to the monomer before polymerizing.

RUBBER DERIVATIVES. F. J. Bouchard (to Hercules Powder Co.). U.S. 2,376,027, May 15. In the preparation of halogenated rubber, the rubber is

reacted in a solvent with the halogen, separated, subjected to an aqueous solution of an inorganic acid, a water soluble hypochlorite is added, and the bleached product is finally recovered.

POLYVINYL BUTYRAL. L. E. Cheyney (to Wingfoot Corp.). U.S. 2,376,030, May 15. A composition of polyvinyl butyral plasticized with 2,2'-di-4-morpholinyl diethyl amine.

ADHESIVE. H. Ford, R. A. Boyer and P. J. Beyer (to Ford Motor Co.). U.S. 2,376,133, May 15. A cement comprising a partial condensate of urea-formaldehyde, soybean meal impregnated with a cured phenol-formaldehyde resin, and monoammonium phosphate.

DISK. H. Kershaw (to Speed-Jack Co.). U.S. 2,376,154, May 15. A coned disk formed of plastic material.

IMPREGNATED MATERIAL. L. Smidth. U.S. 2,376,200, May 15. Fibrous cellulosic sheet materials are impregnated with an aqueous dispersion of urea-formaldehyde condensate and a substance which liberates an acid at high temperatures. The material is cured.

COPOLYMERS. H. Tucker (to B. F. Goodrich Co.). U.S. 2,376,208, May 15. Vinylidene chloride and a butadiene-1,3 hydrocarbon are mixed in aqueous emulsion in the presence of a peroxide catalyst to produce copolymers.

PHENOL-FORMALDEHYDE RESIN. J. E. Watson and K. A. Binder (to Ford Motor Co.). U.S. 2,376,213, May 15. A synthetic resin, partially condensed and capable of dilution in aqueous solution, is formed by refluxing phenol, formaldehyde, pentaerythritol and an alkali catalyst.

MOLD. R. D. Freeman and G. P. Schmelter (to Dow Chemical Co.). U.S. 2,376,244, May 15. A mold for polymerization forming of a plastic object comprising a plaster body having a mold cavity coated with water soluble methyl cellulose, or a water soluble salt of carboxy methyl cellulose.

PACKAGING. K. R. Karlson (to Union Bag and Paper Corp.). U.S. 2,376,256, May 15. A packaging prepared by forming a gusseted tube of paper coated on the inside with a thermoplastic resin, shaping, applying a thermoplastic adhesive, enclosing the packaging contents, and finally heat sealing the bag.

MOLDED ARTICLE. C. A. Bauer (to Hoosier Cardinal Corp.). U.S. 2,376,305, May 15. An object molded from transparent plastic material.

EMULSION COATING. W. G. Lowe and K. P. Griffin (to Eastman Kodak Co.). U.S. 2,376,371, May 22. Photo-

graphic coatings are prepared by adding boric acid to a polyvinyl alcohol-silver halide emulsion, forming a coating, fuming with a volatile base to set the emulsion, coating and drying.

CELLULOSE DERIVATIVES. F. J. Soday (to United Gas Improvement Co.). U.S. 2,376,396, May 22. Cellulose ethers or esters are plasticized with the organic diester of a dihydroxy alcohol.

CELLULOSE DERIVATIVES. H. Dreyfus. U.S. 2,376,422, May 22. Mixed cellulose esters are prepared by esterifying an ester containing free hydroxyl groups in a medium containing the anhydride of a different acid, a halogenated hydrocarbon, and an acidic metal halide, said medium being a solvent for the reaction product.

RESIN. H. F. Pfann and E. L. Kropa (to American Cyanamid Co.). U.S. 2,376,504, May 22. An ester gum produced by reacting abietic acid with a polyallyl alcohol.

YARN. S. G. Saunders and H. Morrison (to Chrysler Corp.). U.S. 2,376,511, May 22. A synthetic yarn made by dissolving in a volatile solvent a phenol- or urea-formaldehyde condensate and polyvinyl butyral or hydrolysis modified polyvinyl acetate, extruding a filament, and curing by heating under tension.

PLASTIC. J. H. Lum and R. L. Schaefer (to Monsanto Chemical Co.). U.S. 2,376,607, May 22. A molding composition comprising a thermosetting phenol-formaldehyde resin and protein-containing cocoa bean material.

LAMINATE. R. V. Boyer (to General Electric Co.). U.S. 2,376,653, May 22. A laminate comprising spaced sheets of laminated fibrous material containing a thermoset resin, an infusible insoluble cellular synthetic resinous composition surrounding and coating a resilient, matted reinforcing filler between the spaced sheets, and spacers of thermoset resin between their inner surfaces.

THERMOPLASTIC. P. Goldstein and H. R. Gillette (to Federal Electric Co., Inc.). U.S. 2,376,687-8, May 22. A thermoplastic product formed by preparing a felted mat of cellulosic fibers, powdered pinewood pitch, and a zinc, calcium or lead oxide, and consolidating the material while dry at 275°F. and 600 to 1000 pounds per square inch.

FASTENING MEANS. J. S. Irvine and R. F. Clark (to Owens-Corning Fiberglas Corp.). U.S. 2,376,698, May 22. The rigidity of fibrous boards is improved by forming a hole through the board and through at least one surfacing layer, and forcing into the hole a hardenable plastic substance with sufficient pressure to spread the substance in the fibrous material to form a plug.

BOOKS AND BOOKLETS

Write directly to the publishers for these booklets. Unless otherwise specified, they will be mailed without charge to executives who request them on business stationery. Other books will be sent post-paid at the publishers' advertised prices.

Proceedings of the Forty-Seventh Annual Meeting, American Society for Testing Materials

Published by the American Society for Testing Materials, 260 S. Broad St., Philadelphia 2, Pa., 1945

Price \$9.00

1131 pages

Divided into three sections entitled Proceedings, Committee Reports and Technical Papers, this volume contains the wealth of information discussed at the 47th annual meeting of the Society. The first section gives a summary of proceedings of the meeting, the annual address by the president—Dean Harvey—and the annual report of the executive committee.

The section entitled Committee Reports contains the general topics of ferrous metals, non-ferrous metals, cementitious, ceramic, concrete masonry and miscellaneous materials and subjects.

Under Technical Papers are found the Edgar Marburg lecture, symposium on analytical colorimetry and photometry; round-table discussion on centrifugal castings; cement, concrete, lime, refractories, masonry materials; miscellaneous; and round-table discussions on organizing the classification of industrial waters.

The Chemical Formulary

—Vol. VII

Edited by H. Bennett

Published by Chemical Publishing Co., Inc., 26 Court St., Brooklyn, N. Y., 1945

Price \$6.00

474 pages

Written to supplement, not replace, the previous six volumes, this book brings up to date the formula reference library of commercial formulation started by the series. This, like the others, is compiled by an editorial board of chemists and engineers in many industries. Thousands of new, practical and tested formulae are contained in the volume which is designed to serve chemist, engineer, executive, manufacturer, instructor, technical worker or layman.

Selling with Color

by Faber Birren

McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y., 1945

Price \$2.50

244 pages

American business knows the value of color in making sales, but it is also aware of certain hazards and pitfalls. To make color work for profits, those who use it must know the public heart and mind—how to give people what they want. To-

ward this end, *Selling with Color* was written. The book purports to present facts rather than opinions and to set forth principles that have the support of extensive research and sales record. In order to show how color affects the consumer, the author discusses public taste and color preferences, the kind of things people buy. He goes into color conditioning, the psychology and the romance of color. He brings to sales and merchandising executives, stylists and designers the practical tested principles of color, treating the subject throughout as a business science.

Technical Data on Plastics

Compiled and published by the Plastics Materials Manufacturer's Association, Tower Building, 14th and K Streets, Washington 5, D. C., 1945

Price \$1.50

164 pages

This new edition, the first since August, 1943, was written "to acquaint its user with the nature, particular merits and utility of various plastics and with property values, as measured by recognized methods, commonly to be expected in available forms and modifications of the various basic compositions."

Incorporated in the edition are changes and additions to previous data, and property summarizations on cast allyl and polyethylene plastics. Low pressure laminating plastics are described, although data on the present status of development are not available.

Twenty types of material are covered in the booklet which attempts to tabulate all data for the use of those in government agencies concerned with the application of plastic material in war effort.

★ CHILEAN PLASTICS MARKETS

and casein are the subjects of two numbers of the Industrial Reference Service, Part 2 on Chemicals, Drugs and Pharmaceuticals, published by the Bureau of Foreign and Domestic Commerce, U. S. Dept. of Commerce which have been received. Number 11 for May 1945 discusses Chilean plastics markets, covering production, distribution and advertising, Chilean plastics import trade, and opportunities for greater service. Number 18 for the same month is a synopsis of information on casein which includes the topics of grades, standards and specification, uses, sources of world supply, shipping and packaging, methods of production, output, exports, imports, prices, tariff and lists of producers and dealers, trade associations and economic references.

Both reports are for sale by the Superintendent of Documents, U. S. Government Office, Washington 25, D. C., or Department Field Offices, for 5 cents each. The annual subscription rate is two dollars.

★ THE RESULTS OF TESTS FOR DIMENSIONAL STABILITY AT HIGH TEMPERATURES AND HIGH HUMIDITIES, conducted in its own laboratories on cellulose acetate, cellulose acetate butyrate and ethyl cellulose are reported by Hercules Powder Co., Inc., Wilmington, Del., in a technical bulletin entitled "Cellulosic Thermoplastics." Tests were made on heavy bars, medium disks and thin strips which were injection molded and thin strips which were extrusion molded of each product in formulations of different degrees of hardness.

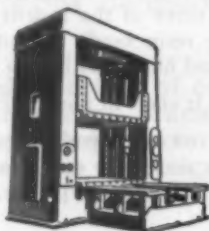
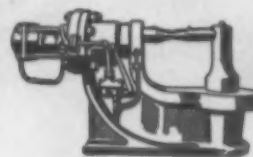
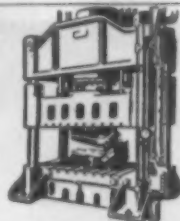
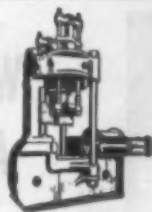
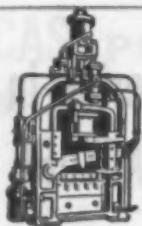
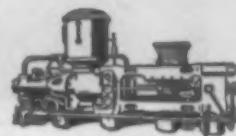
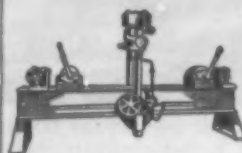
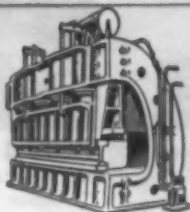
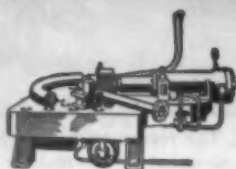
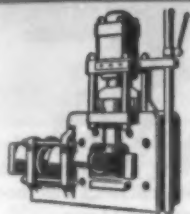
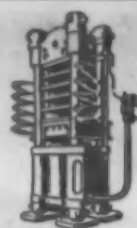
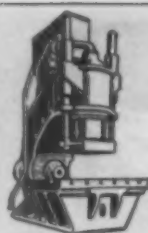
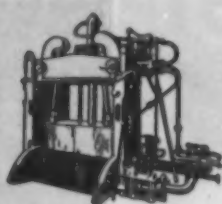
★ A CONCISE LITTLE BROCHURE with a plastic cover received from Arnold Brillhart, Ltd., Great Neck, N. Y., gives brief but pertinent information on plastics, their designing and engineering, and methods of molding and fabrication. A list of materials and trade names is included.

★ THE "STANDARD FOR THERMOPLASTIC-INSULATED WIRES," as set by the Underwriters Laboratories, Inc., New York 13, N. Y., is presented in a publication with that title. The booklet lists and defines requirements for thermoplastic-insulated wires in accordance with the National Electrical Code. These cover single-conductor wires employing soft-annealed-copper conductors and having no fibrous coverings and are based upon records of tests and field experience, subject to revision in line with further experience and investigation. Instructions to inspectors and procedure of inspection are also enumerated.

★ RECEIVED FROM DUREZ PLASTICS & CHEMICALS, Inc., North Tonawanda, N. Y., is a pamphlet cataloging the molding compounds, industrial resins and oil soluble resins produced by the company. Plywood resins, water soluble resins and resins for varnishes and paints are among those groups included.

★ SURFACE FINISH SPECIMENS and quality control is the subject of a booklet published by Sav-Way Industries, Detroit, Mich. This guide explains the meaning of terms connected with machined finishes, the different types of surfaces and methods of measuring surface finishes. Drawings illustrate the direction of tool marks in 16 standard machining operations.

HIGH PRODUCTION HYDRAULIC PRESSES FOR ALL PURPOSES



*This BALDWIN
SHAPES THE WHEELS that
SHAPE THE METAL
for you!*

The abrasive wheels that you use to remove surface flaws from billets and blooms, or to put a micro-finish on some finished part, were more than likely formed on a Baldwin press.

The illustration shows one such press, built by Baldwin for an important abrasives producer. Using 750 tons of hydraulic pressure, it integrates diamond-hard particles and a binder into a "saw without teeth," that can cut steel as a rat gnaws cheese.

One of the best reasons for coming to Baldwin for your presses is that Baldwin has built practically every kind and variety. What is a brand new problem to you may be an already solved one to our engineers. This eliminates any uncertainty or experiment, assures that the press will do your job right the first time. Ask for Press Bulletin No. 160.

Baldwin Locomotive Works, Baldwin Southwark Division, Phila., Pa., U. S. A. Offices: Philadelphia, New York, Washington, Boston, Chicago, Cleveland, St. Louis, Detroit, San Francisco, Houston, Pittsburgh.



BALDWIN
HYDRAULIC PRESSES



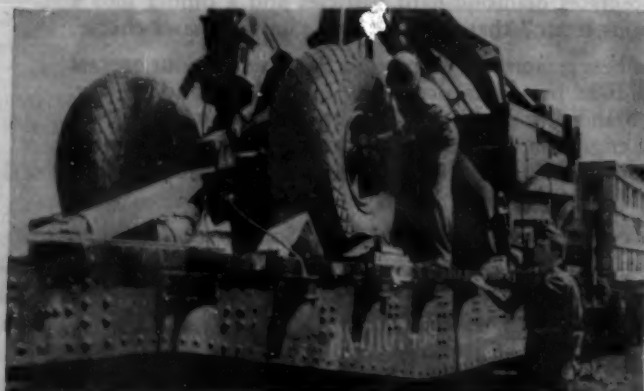
Clearing the Way! Glycerine will help produce the vast quantities of explosives needed for postwar harbor clearance, building and rebuilding. One of the great reasons glycerine is used in making dynamite is that it doesn't separate from other materials.



The Road Back. The return-to-health is aided by C.P. glycerine, an important component in the making of many pharmaceuticals. Glycerine, the versatile solvent, humectant, carrier, has been proved safe in pharmaceuticals through generations of use.



Tough Job! Long-lasting modern paints for war equipment, and for widespread industrial and home use, are made with an alkyd resin base. Glycerine is important in the making of these resins.



Keeping 'Em Rolling! Glycerine is used in the processing of synthetic and natural rubber goods and many other important war materials. You, too, can use glycerine in your products!

Why Glycerine is Superior in ALKYD RESIN MANUFACTURE

Glycerine is—

Efficient. All three of the hydroxyl groups are reactive, yet reaction in the resin kettle is controllable. Glycerine-derived alkyds set to hard films, and have a low acid number.

High-boiling. It stays in the kettle.

Pure. When you buy glycerine, you aren't buying a mixture of polyhydroxy materials, or unwanted impurities—you buy just glycerine.

Glycerine has—

Complete availability of hydroxyl groups. No internal dehydration at ordinary kettle temperatures. You get full value with glycerine.

A long record of service to the resin industry. High utility, low price, unique properties.

Glycerine is valuable not only in the making of alkyd resins, but in hundreds of other products. Its high viscosity, high solvent power, compatibility, nontoxicity, permanence, and other advantages make it a superior humectant, plasticizer, solvent, preservative, lubricant, hydraulic fluid, and component in many essential materials.

GLYCERINE PRODUCERS' ASSOCIATION

285 Madison Avenue, New York 17, N. Y., Research Laboratories, Chicago, Ill.



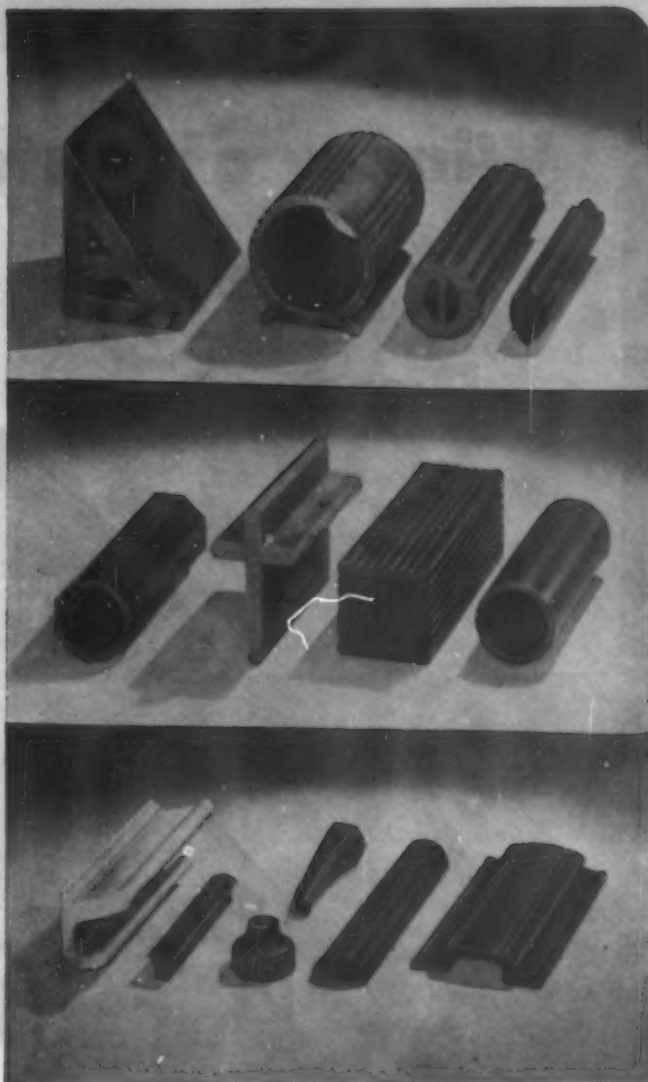
Scientific Nutrition. Many foods, food products, and food-packaging materials call for the use of C.P. glycerine—which is a natural product—and a food itself. Use wholesome glycerine!

MARBLETTE

THE *Versatile* PLASTIC

A CAST PHENOLIC RESIN OF EXCEPTIONAL QUALITIES

- Outstanding among plastics, Marblette has a jewel-like depth and a complete color range which duplicates the appearance of precious stones, tortoise shell and ivory.
- Its almost infinite variety of colors is available in transparent, translucent, opaque, or in mottled effects. Marblette also comes in a waterclear form known as "Crystle" in a wide choice of colors.
- Marblette's machining characteristics, resistance to oil and acids, non-inflammability and exciting beauty make it ideal for countless manufacturing needs.



A few of the many types of Special Marblette castings made to customer's specifications.

SPECIAL CASTINGS

Marblette is supplied in sheets, rods, tubes, and special castings such as cutlery handles, kitchen utensil handles, pipe stems, cigarette holders, clock cases, automotive trimmings, jewelry items, buckles, etc. Special shapes made to customer's specifications can be supplied provided draft is all one way.

MARBLETTE LIQUID PHENOLIC RESINS

Casting Resins for Forming Dies and Tools

Metal Casting Sealing Resins

Bonding Resins

Low Pressure Laminating Resin

Bristle Setting Cement

Laminating and Insulating Varnish

Clear Phenolic Lacquer



MARBLETTE WILL HELP PLAN YOUR WORLD OF TOMORROW

The Marblette staff of engineers offers its services to help with your manufacturing problems. Write to us outlining your needs.

Winner of History's Greatest Race...



Since 1941, America has raced against Time—and won. During all the months of war, the General American Tank Car Fleet has been in action . . . transporting a hundred different vital liquids safely, surely—and economically.

To carry your postwar products, General American will design and build tank cars with every protective feature you need. They will help you win another great race—the future race against competition.



**GENERAL
AMERICAN
TRANSPORTATION**
CORPORATION
CHICAGO



seve

That ra
ing insu
the seve

Mica
phenol
of war
ease an
phenolic
pression

For c
this pro
PANY, I

3 REASONS why mica-filled RESINOX 7934

comes through under
severest operating conditions



Low Water Absorption

—only 0.030% by weight
after 24 hours' immersion



Low Dielectric Constant and Power Factor

Dielectric constant at 1 K.C.

—4.35 to 4.50

Dielectric constant at 1 M.C.

—4.20 to 4.50

Power factor at 1 K.C.

—0.015 to 0.017

Power factor at 1 M.C.

—0.0080 to 0.0085



Heat Resistance

Relatively high heat resistance—important where leads are assembled to molded parts by a hot soldering iron.

That rare 3-way combination of Resinox 7934 properties gives *unfailing insulation* to vital medium and high frequency apparatus under the severest operating conditions, especially extreme humidity.

Mica-filled Resinox 7934, based on a recently developed Monsanto phenol formaldehyde resin is available now for molders of all types of war essentialities. Molders have found that Resinox 7934 offers ease and economy in molding, far superior to ordinary mica-filled phenolics...also that it is suitable for both transfer and compression molding.

For complete information and technical counsel on the use of this product, write, wire or phone: MONSANTO CHEMICAL COMPANY, Plastics Division, Springfield 2, Massachusetts.

The broad and versatile family of Monsanto Plastics includes: Lustron® polystyrenes • Cerex® heat resistant thermoplastics • Vinyl acetals • Nitron® cellulose nitrates • Fibreston® cellulose acetates • Resinox® phenolics • Tholid® for impression molding • Resimene® melamines • Forms in which they are supplied include: Sheets • Rods • Tubes • Molding Compounds • Industrial Resins • Coating Compounds • Vuespak® rigid, transparent packaging materials. * Reg. U. S. Pat. Off.





Moulding—

Moulding that meets the exacting demands of the latest moulding materials is another of the complete list of services that Bridgeport offers you. Bridgeport is completely equipped to handle your moulding problems from the early stages through to the finished product. For post-war plastics think of Bridgeport.

BRIDGEPORT MOULDED PRODUCTS, INCORPORATED

BRIDGEPORT **B** CONNECTICUT



**"Let every man practice
the art he knows best"**
CICERO

In Music long years of living the moods of the composer must precede a successful interpretation of his scores.

IN ADHESIVES long years of experience — with the mechanical and chemical requirements of every type of adhesion — is a necessary foundation for the successful application of synthetic resins to today's bonding problems. National... a specialist for half a century in all types of industrial adhesives and a pioneer in the development of synthetic resin adhesives... offers you the advantages of an experience that goes far beyond the formulation of a single type or limited group of resins. All types, both singly and in blends of high complexity are employed for packaging, converting, assembling. And further, each specific recommendation justifies itself economically.

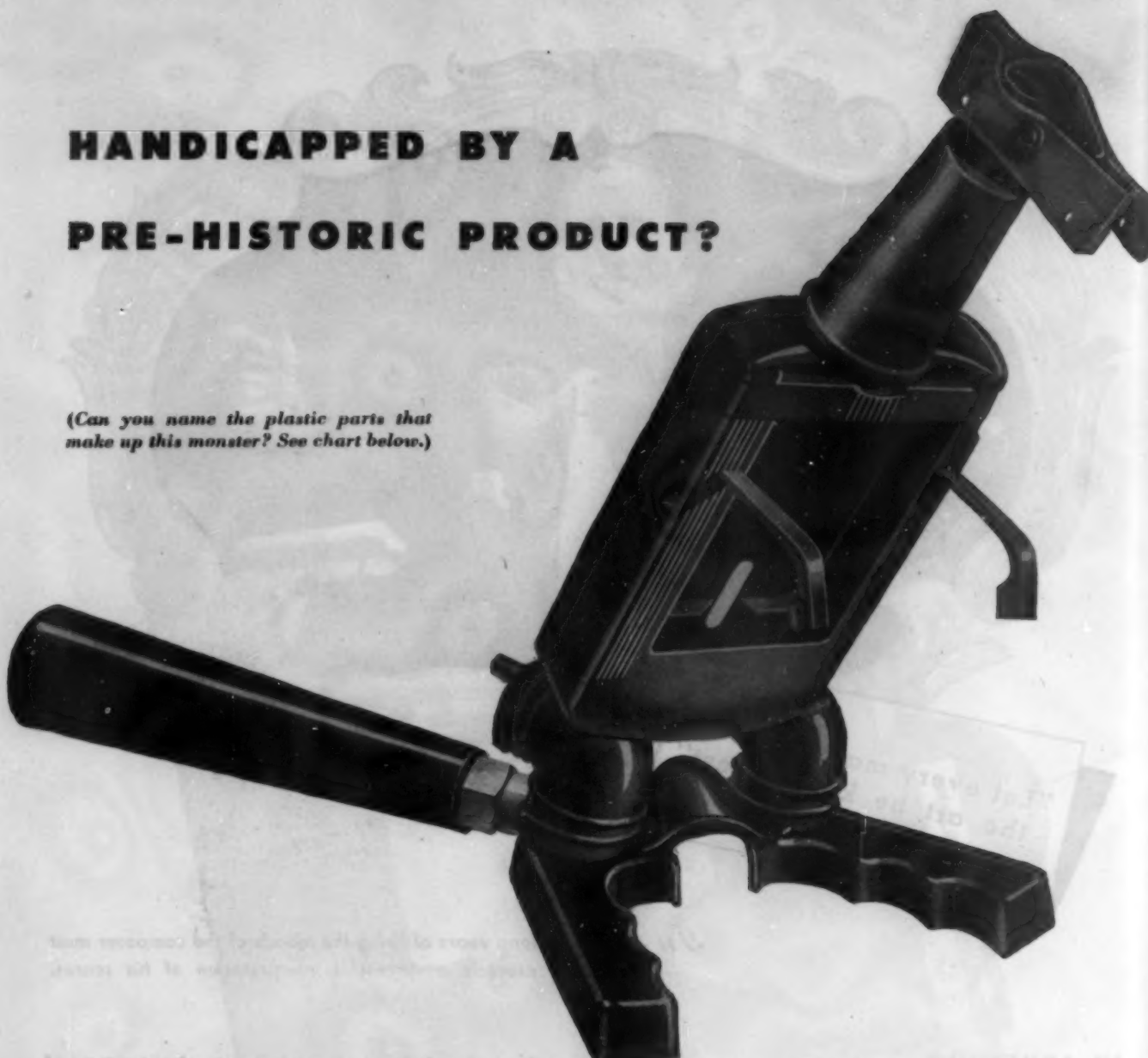
Offices: 270 Madison Avenue, New York 16;
3641 So. Washtenaw Avenue, Chicago 32; 735 Battery Street,
San Francisco 11, and other principal cities.
In Canada: Meredith, Simmons & Co., Ltd., Toronto
and Montreal. In England: National Adhesives
Ltd., Slough, Bucks.

National
ADHESIVES

EVERY TYPE OF ADHESIVE FOR EVERY TYPE OF ADHESION

HANDICAPPED BY A PRE-HISTORIC PRODUCT?

(Can you name the plastic parts that make up this monster? See chart below.)



If you are, take a good look at this odd-looking monster.

He's a very remarkable beast. Pre-historic perhaps—BUT—please notice we carefully made *our* monster out of some very up-to-date material. He's composed entirely of eight separate plastic products made in Continental's plastics plant at Cambridge, Ohio.

His body is a billing-machine housing of phenolic made by compression; his neck, a sales ticket-holder made the same way, while his head

is a landing-light part of cellulose acetate formed by injection.

These are just a few of the variety of plastic products we make for various industrial uses. All our products are the result of combining years of designing, engineering and manufacturing experience, with our increased production facilities and resources. Such a combination means we can promise you a *wholly modern* solution to any problem you may have for improving old products or bringing out new ones.

Tune in "REPORT TO THE NATION," every week over coast-to-coast CBS network.

CONTINENTAL



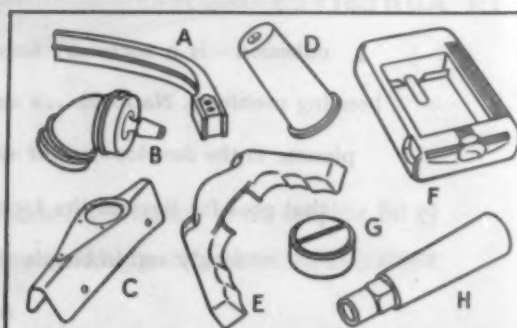
PLASTICS
DIVISION

CAN COMPANY, INC.

HEADQUARTERS: Cambridge, Ohio

Sales Representatives in all
Principal Cities

COMPRESSION • INJECTION • EXTRUSION
SHEET FORMING • LAMINATION



(A) Pot handle—compression; (B) nozzle intravenous bottle—compression; (C) landing-light part—injection; (D) sales ticket-holder—compression; (E) gun handle—compression; (F) billing-machine housing—compression; (G) brush cap for motor—compression; (H) tractor handle—compression.

Other Continental Products: Metal Containers • Fibre Drums • Paper Containers • Paper Cups • Plastic Products • Crown Caps and Cork Products • Machinery and Equipment.

*Let us be your plastics
research laboratory!*

*Take advantage
of our engineering and
production experience in
the field of industrial
plastics.*

*For your tough plastics problems,
IN COMPRESSION, INJECTION, TRANSFER
MOLDING and PRECISION MACHINING*

ARNOLD

Brillhart
LTD.
435 MIDDLENECK RD. GREAT NECK, N.Y. Phone: GREAT NECK 4054

• Fibre
• Plastic
• Ma-

SEE US ABOUT PLASTICIZERS FOR

VINYL COPOLYMERS
POLYVINYL CHLORIDE
POLYVINYL BUTYRAL
NITRO-CELLULOSE

CELLULOSE
ACETOBUTYRATE
ACRYLIC RESINS and
SYNTHETIC RUBBERS



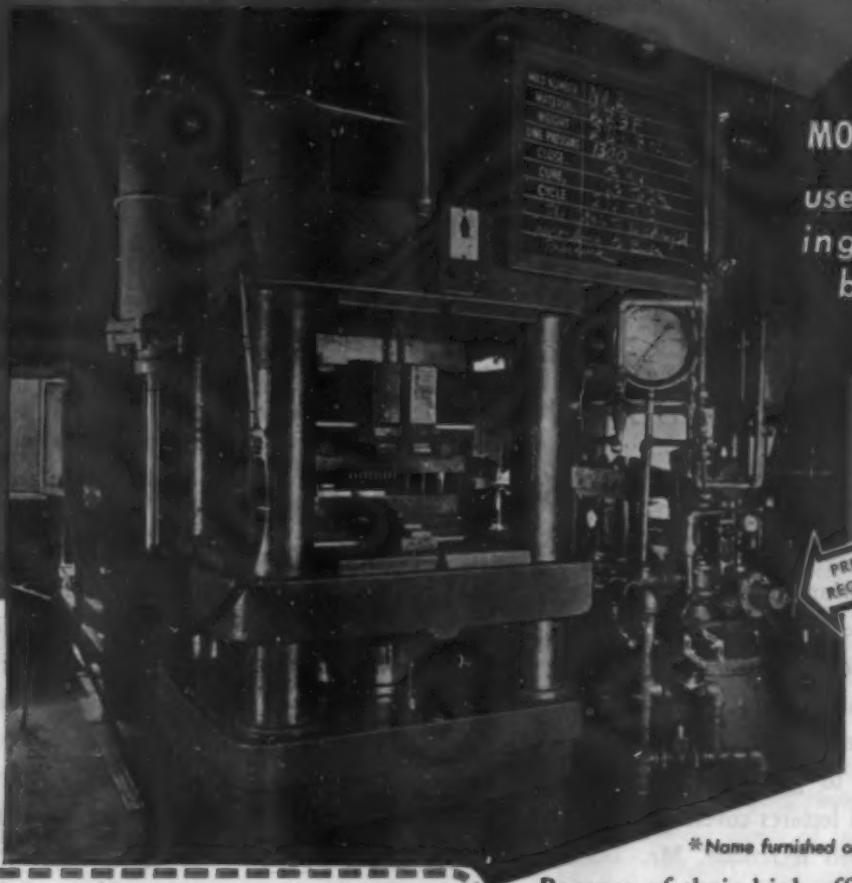
PLASTICIZERS

Alkyl Sebacates
Dibutyl Sebacate
Capryl Alcohol

HARDESTY CHEMICAL CO., INC., 41 EAST FORTY-SECOND STREET, NEW YORK 17, N. Y.

LINCOLN

2-Stage HYDRAULIC SYSTEMS WITH SELECTIVE INTENSIFIERS



A MIDWEST
MOLDING COMPANY*
uses these outstanding
systems on a
battery of 14
presses

PRESSURE
REGULATOR

You, too, Can Save
Time, Cut Operating
Costs and Provide
Positive Pressure
Control on Your
Presses...

*Name furnished on request.

LINCOLN BOOSTER PUMPS for Hydraulic Systems

All Lincoln Hydraulic Systems feature this Lincoln Booster Pump. These pumps are powered by the famous Lincoln Air Motor which has proved its reliability and efficiency in many industrial applications and under the most severe operating conditions.

Because of their high efficiency, Lincoln Hydraulic Systems are fast winning favor with plastic molders everywhere. The midwest user whose press is illustrated, installed a single system on one of their presses. It performed so satisfactorily that they immediately installed Lincoln Hydraulic Systems on their battery of fourteen presses. They report that the entire battery operates from a 15-h.p. compressor, whereas with direct drive hydraulic equipment their requirement would have been considerably greater. It will pay you to investigate.

HYDRAULIC SYSTEM SELECTION

Recommendations of the proper Lincoln System will be made by our Engineers upon receipt of the following information ... Ram Diameter—Maximum Stroke—Platen Size—Total Weight of Platen, Ram and Dies—Distance and Speed of Daylight Closing—Maximum Compression Stroke—P. S. I. Ram Pressure—Time of Cycle desired—and any other related facts affecting operation.

LINCOLN ENGINEERING CO. ST. LOUIS 20, MO.

Please send complete bulletin ☐, or recommendations on the basis of the attached specifications ☐.

Name _____

Title _____

Company _____

Address _____

City _____ State _____

LINCOLN ENGINEERING COMPANY

Pioneer Builders of Engineered Hydraulic Equipment

5701 NATURAL BRIDGE AVE., ST. LOUIS 20, MO., U. S. A.

HIGH-FREQUENCY PRE-HEATING INSTRUCTION

being emphasized at
PLASTICS INDUSTRIES



Kennith V. Tindall (left), electronics expert, explains the function of a radio-frequency generator to students at Plastics Institute.

TECHNICAL INSTITUTE

Because of the growing importance of heatronic molding within the plastics industry, Plastics Industries Technical Institute has expanded its program of instruction in this subject by engaging the services of Kennith V. Tindall, electronics expert, to give students practical demonstrations and lectures covering the latest developments in this technique. Mr. Tindall has a background of ten years' experience in industrial electronics and is presently engaged

as Chief Sales and Applications Engineer with a well-known manufacturer of preheating equipment for the plastics field.

This emphasis upon heatronic molding is further evidence of the constant effort made by Plastics Institute to provide modern, practical, plastics training of maximum value to its students and the plastics industry. We cordially invite your inquiries regarding resident training and the home study course.

VETERANS ELIGIBLE FOR G. I. TRAINING

A number of World War II Veterans are taking advantage of the educational provisions in the G. I. Bill of Rights to receive practical training at Plastics Industries Technical Institute. To any of your former employees returning as veterans or to any other servicemen who are interested in obtaining plastics education—we will be happy to send information explaining their privileges and details concerning our training program. Please write us.

Plastics
INDUSTRIES TECHNICAL
INSTITUTE
Francis A. Gudger, President • John Delmonte, Technical Director

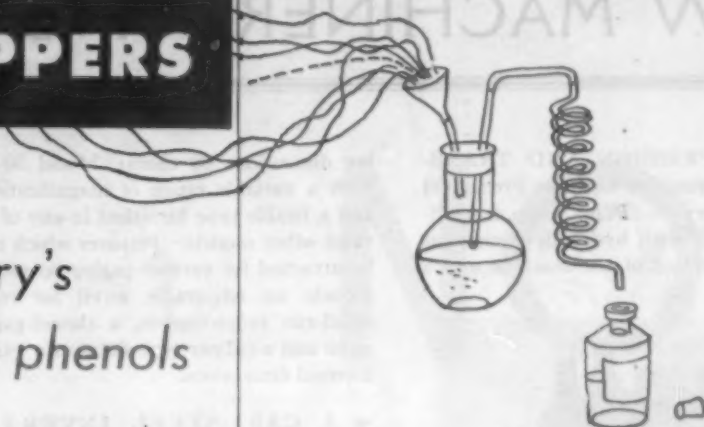


WRITE DEPT. MP5-B

823 EAST 42ND ST., NEW YORK 17, N. Y. • 221 NORTH LA SALLE ST., CHICAGO 1, ILL. • 1601 SOUTH WESTERN AVE., LOS ANGELES 6, CALIF.

KOPPERS

is one of the industry's
principal sources of phenols



Koppers

Tar Acids (Phenols) are
used in the production of
phenolic resins, laminat-
ing varnishes, solvents for
resin coatings, plywood
glues, oil soluble var-
nishes, plasticizers, etc.

KOPPERS COMPANY, INC.

TAR AND CHEMICAL DIVISION • PITTSBURGH 19, PA.

Buy War Bonds

KOPPERS PHENOLS

—Koppers Phenols are obtained from the natural tar acids present in coal tar from byproduct coke oven plants. They are available not only with melting points of 39°C. and 40°C., but also as 90% phenol with about 10% ortho cresol, and as 82% phenol with 2% to 3% meta-para cresol and the remainder ortho cresol. Koppers furnishes every blend of phenol and cresol required by industry.

KOPPERS CRESOLS

—Koppers offers pure ortho cresol, melting point 30.4°C. 95% meta-cresol, meta-para cresol, and many blends of the three with some phenol and xylene content. Samples gladly furnished upon request.

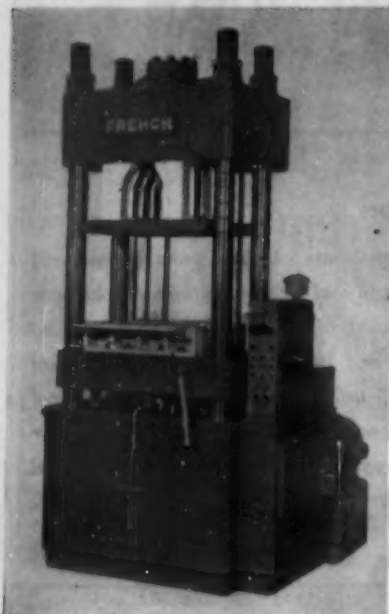
KOPPERS CRESYLIC ACIDS

—Tar acid content not less than 99%, composed of cresols and xylenols are available, made to all specifications. Symmetrical 3,5 meta xyleneol with melting point not less than 60°C. is also available.

and keep them!

NEW MACHINERY AND EQUIPMENT

★ A COMPRESSION AND TRANSFER molding press developed by French Oil Mill Machinery Co., Piqua, Ohio, is a self-contained unit with hydraulic equipment built into the bed of the machine and a



separate transfer ram mounted in the head. Two pumps make possible entirely independent pressure adjustments. Extremely flexible, according to the manufacturer, the timing controls can be set to give complete manual control of both rams when a job is being set up or can be set for automatic control for compression cycle or automatic control for transfer cycle with either an open end or a closed end transfer cylinder. These adjustments allow for variance in time, pressure, speed and gassing interval. The 100-ton press is powered with a 5-horsepower motor, the 200 ton press with a 7½ horsepower motor.

★ DETROIT MOLD ENGINEERING Co., Detroit, Mich., has announced a new line of standard ejector pins in a design featuring a wear-resistant body with a tough core said to be capable of long runs without distortion of close tolerances. The pins are at present available in 17 diameters ranging from 1/8 to 3/4 in. and in any desired length. According to the manufacturer, pins of smaller diameter are now under experiment.

★ SIMPLIFIED INSPECTION OF parts held within close tolerances is claimed for the line of Micro-Chek comparator gages produced by Trico Products Corp., Buffalo 3, N. Y. The four basic types of gages are Model A, multiplying dimensions 200 times; Model B, multiply-

ing dimensions 60 times; Model 50-400 with a variable range of magnifications; and a Braille type furnished in any of the three other models. Fixtures which may be attached for various gaging operations include an adjustable anvil for many small-run requirements, a thread-gaging anvil and a caliper type fixture for gaging internal dimensions.

★ A CAST-STEEL INVERTED bucket steam trap with side inlet and side outlet pipe connections has been developed by Armstrong Machine Works, Three Rivers, Mich., for use with pressures up to 600 lb. or where all-steel fittings are desired. These traps are used to discharge automatically condensate from steam-consuming equipment such as presses without any loss of steam.

★ BRISTOL CO., WATERBURY 91, Conn., has developed an instrument which records machine running-time and can be used for checking machine performance. Total "on" and "off" time in hours, minutes and seconds for a given period are recorded on a chart.

★ CLIMAX ENGINEERING CO., Clinton, Iowa, has announced plans for entering the electronics field with a line of high frequency heaters as soon as the WPB give its approval. The new heater is said to provide quick, efficient localized



heat for surface hardening, annealing and brazing. Suggested applications are in the food industry or in any industry where heating of non-metallic materials plays a part. Present plans include production of 12 models of standard electronic heaters, for which an Electronics Division is being established.

★ DOUGLAS MACHINERY CO., INC. New York 7, N. Y., has announced a new model of the Rotorex precision tapping at-



tachment which can be used with all popular model drill presses. The attachment gives Class III threads and can be used by unskilled workers. Positive, automatic control of lead is said to be possible, assuring precision tapping and accurate control of depth to a tolerance of .001 inch. Instantaneous emergency reverse, complete automatic cycle and foot control are featured in the tapping attachment which permits change-over from tapping to drilling or vice versa in 5 minutes.

★ ACROMARK CO., ELIZABETH, N. J., has announced the development of a machine for marking at high temperatures cylindrical and tubular plastic parts requiring especially prominent or attractive markings. Designated as the Acromark 9AHS marking machine, the device features a heating head containing two cartridge units which heat the specially engraved steel die. Automatic feed rolls carry the concentrated transfer tape through the machine between the die and the part, while an incline chute conveyor transports the parts to a position in front of the marker where they are fed to the machine by hand or automatically.

★ A COMPLETE NEW LINE OF portable infrared equipment for multiple baking, drying, dehydrating and preheating operations has been developed by Fostoria Pressed Steel Corp., Fostoria, Ohio. The four models in the group are said to provide radiation coverage ranging from 275 to 2000 square inches. Radiation in any direction is made possible by the manner in which the reflector assemblies are attached to the upright support and base by an arm with a rotating swivel device.



Yes

and



No

Sooner or later, in every business, there comes a time when the choice must be made: is the material right, is the design sound, should I go ahead and make it?

This problem can be particularly knotty in plastics. Many applications are pioneer jobs. The only bases one can have for making the final determination are past experience (as the first extruder, we have had plenty of *that*) and adequate testing

(we believe firmly in *this*).

When the occasion has demanded it, we have not been afraid to say "NO", even though the orders were large and the profits secure. We have been equally unafraid to say "yes", and, as evidence, we point to scores of MACOID "first" applications of extruded plastics to all fields of industry. We are especially known as a contributor to progress in aviation, automobiles, furniture, refrigeration and agriculture.

We also do injection molding.



ORIGINATORS OF
DRY PROCESS PLASTIC EXTRUSION

WASHINGTON ROUND-UP

R. L. VAN BOSKIRK, Washington Editor

Control of plastics for civilian uses

As we go to press, it is becoming obvious that practically all plastics intended for civilian end uses will go under order M-340. In effect, this means that all material left over after military demand is supplied will be left in the hands of producers to distribute as they see fit. Urea and melamine, nitrocellulose plastics and vulcanized fibre have already been placed under M-340. Most other plastics will probably be transferred from M-300 to M-340 before December 1, according to Chemicals Bureau officials.

In so far as processors are concerned, there is almost no difference between distribution of raw materials under M-340 and under the paragraph (f) method of M-300. The most noticeable difference to a processor is that under M-340 there is no necessity to file reports with WPB. Military orders must be filled first and the customer must certify to his supplier that he is requesting material for a military job and indicate the preference rating in the usual manner. If an order is received by the supplier with a rating but without a certificate stating that it is a preferred order, the supplier is directed by the terms of M-340 to disregard the rating and schedule the order as unrated.

The only check-up which WPB has is in case of a complaint from the military or from a customer who may not be obtaining a sufficient quantity of material to complete Army or Navy contracts. There is also an inventory control, which limits a customer's stock to orders he has on hand which call for delivery of the end product during the next 60 days.

Order M-340 was further amended on July 26 so that no supplier may be required to make delivery during the succeeding calendar month on any purchase order bearing a preference rating below AAA for subject chemicals placed with him less than 10 days before the close of the calendar month. This in effect means that suppliers will not have to break into their runs to fill a preference rating unless it is a military AAA.

Another important phase of M-340 is that it prohibits the use of material that has been received on a preferred military basis for civilian purposes in case the military order should be cancelled. Before such material can be used for anything other than its originally intended purpose, it must be especially authorized in writing by the War Production Board.

It is probable that no material will be placed under M-340 until more than half of the total production is available for civilian uses. Furthermore, officials will endeavor to make certain that the great

bulk of the military business is *not* confined to one producer, leaving all the others free to engage in civilian business only. It is also possible that when a raw material is placed under M-340 the producers will have trouble obtaining other needed items, containers for example, because placing a material under M-340 automatically indicates that it is no longer critical and it is difficult to obtain such things to serve as containers for less critical materials.

Phenolic situation

There has been considerable confusion in the phenolic situation in the past two months, principally because molders were receiving heavy cutbacks in their military orders and yet were having difficulty in obtaining raw material for new civilian orders.

There were many factors involved in this situation. The capacity for production of phenolic molding powder is about 12 million pounds a month. Molders asked for almost 20 million pounds in July and only slightly less in August. It is doubtful that they have orders for end products that would use up that quantity of material. Furthermore there is a belief that many molders do not notify their supplier when they receive a cancellation of a military contract although it would be illegal for them to use molding powder thus obtained for any other purpose than the military job for which it was intended. WPB is lenient in permitting use of this material for other things, but it is necessary that they be notified of the cancellation in order to help keep production smoothed out.

There is sufficient phenol and formaldehyde to supply the 12 million pound capacity for phenolic molding powder, but suppliers have been handicapped because of manpower shortages which continue to exist. Furthermore, all suppliers have a large backlog of unshipped allocations which presumably will be filled before new orders for civilian goods can be taken care of.

Actual military demand for August delivery was approximately 5,500,000 pounds. With the highest essential civilian items such as electrical equipment, safety equipment, etc., added, the total probably would not exceed 7 million pounds. Only a few months ago, 10 million pounds were required for military plus high essential civilian items.

Theoretically, then, there should be somewhere in the neighborhood of 5 million pounds for the producers to distribute as they please. For the reasons stated above, that actual poundage could

not be shipped to new orders for August delivery. But it takes no genius to realize that just as soon as manpower and back order problems are leveled out there is going to be more phenolic material available for the civilian trade than there was before the war. At the same time there will be plenty to meet all military needs.

Of course, there is always a chance that new items for the military program may result in increased usage of phenolic, but at the moment the trend is downward. For example, orders from customers to their suppliers for material for M-52 mortar shell fuzes dropped approximately one-half in August from the highest amount ever recorded in one month. It is known that at one time the M-52 was requiring more than 1 million pounds a month. Part of the drop in August was probably caused when molders realized that cutbacks were coming along and felt that they had enough molding powder in inventory to take care of their contract commitment for several weeks. Consequently they cut their orders for new material in considerable quantity.

Plastics machinery

It is no longer necessary to apply to WPB for permission to acquire plastics machinery that is to be used for production of civilian goods. The method for making the change is embodied in WPB's Direction 1 to Table 15 of Order M-293, which is the general scheduling order for machinery.

Preference ratings will still be given for plastics machinery when it can be definitely tied up with a military project. In such cases, the manufacturer will schedule those machines ahead of any that may be ordered for other than military work. If an applicant for a machine submits a Form WPB-1319 and government officials decide that it is *not* entitled to a preference rating, the application will be sent back to the applicant and he will be instructed to order his desired machine direct from the manufacturer.

The situation for the delivery of injection machines during the last quarter of this year is fair, according to machinery manufacturers. They believe it will be possible to deliver all machines that have previously been allocated before the close of the third quarter and that their entire fourth quarter production, except for a few machines which will be needed by the military, can be distributed to their customers as they see fit. They expect to produce more machines than ever before during the war period, but admit that demand is running ahead of potential supply in a ratio of about 3 to 1.

ditor

ugust
realize
back
ere is
avail-
e was
there
eds.
e that
may
e, but
ward
rs to
mor-
y one-
mount
nown
airing
onth
bably
cut-
that
in in-
tract
onse-
y ma-

ly to
astics
duce-
d for
PB's
-293.
er for
n for
defi-
In
edule
ay be
k. If
Form
s de-
rence
ck to
ed to
n the

injec-
er of
inery
ll be
have
close
entire
for a
d by
their
et to
efore
t de-
upply

it's new! SARAN braid

resists

rot,

oil,

moisture,

abrasion,

heat,

cold

for better electrical insulation

Cable and wire braid with insulating qualities far superior to any other material—that's the stimulating news brought by this announcement of Saran braid. It marks an important advance in wire protection and provides long-sought answers to many troublesome problems.

Here is a braid that resists abrasion—Saran is permanently tough and durable. It is fungus and mildew proof—long life is the rule even under adverse service conditions. And, more important to the electrical industry, Saran defies moisture and oil—enemies that attack, and soon rot, ordinary cable coverings.

These better insulating properties point to the use of Saran in myriad applications* extending all the way from simple extension cords to intricate wires in radio and radar. If you would like to know more about its value to you, write for further details.

Let's work it out together

Success in plastics is not a one-man nor even a one-industry job. It calls for the cooperation and combined skill of manufacturer or designer plus fabricator plus raw materials producer. Working together, this team saves time and money and puts plastics to work successfully. Call us—we'll do our part.

PRESERVE AND POTENTIAL USES: Braided covering for wires and cables of all kinds. Especially valuable in guarding against abrasion in such applications as extension cords, etc. Many uses for cable such as household appliances and that is exposed to moisture and corrosion. Guarding of flexible tubing in the case of oil, acid, or other liquid. Suitable for use in many applications in automotive wiring.

PROPERTIES: Combines toughness with flexibility even at low temperatures. Resistant to moisture, oil, fungus, mildew, and acids. Resistant to abrasion and impact. Excellent dielectric properties. Available in many colors. Suitable for use in many applications.

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN
New York • Boston • Philadelphia • Washington • Cleveland • Detroit
Chicago • St. Louis • Kansas City • San Francisco • Los Angeles • Seattle



PLASTICS

STYRON • STYRALOY • ETHOCEL • ETHOCEL SHEETING
SARAN • SARAN FILM • STRIPCOAT

NEWS OF THE INDUSTRY

★ **THE COVETED JOSEPHINE Snapp Award** for the most outstanding contribution to advertising made by a woman in the United States has been presented to Harriet E. Raymond, assistant advertising manager of Celanese Corp. of America, New York, N. Y., in charge of plastics and chemicals. The award is given annually by the Women's Advertising Club of Chicago.

★ **THE APPOINTMENT OF G. A. Gustafson** to the position of construction manager of the Plastic Divisions, General Electric Co., Pittsfield, Mass., was announced recently. His former post as manufacturing manager of the Plastics Divisions will be assumed by L. S. Gleason, manager of Pittsfield Molding Works. The creation of the position of construction manager was necessitated by plans for expansion which include new plastics plants at Anaheim, Calif., and Albion, Mich., a laminating plant at Coshocton, Ohio, additional manufacturing facilities at Scranton, Pa., and an addition to the engineering development laboratory at Pittsfield.

★ **UNITED STATES PLYWOOD Corp.**, New York 18, N. Y., has announced the formation of an Industrial Adhesive Division with W. Robert Goepel as its manager. The new division will have headquarters in the company's main office in the Weldwood Building, 55 W. 44th St., New York City. A separate department in the division will be devoted to Pliobond, all-purpose plastic adhesives developed by Goodyear Tire & Rubber Company, Inc., and will be managed by E. A. Filley, formerly with the plastics and coatings division of that company.

★ **NEWLY FORMED, THE NIACET Chemicals Division** of U. S. Vanadium Corp., unit of Union Carbide and Carbon Corp., New York 17, N. Y., will manufacture and market products formerly made and sold by Niacet Chemicals Corp., Niagara Falls, New York.

★ **DUE TO THE PAPER SHORTAGE**, an index to Volume 22 of *Modern Plastics* (Sept. 1941-Aug. 1945) is not included in this issue. However, a limited number of indexes have been printed and are available to subscribers who request them from the Reader's Service Dept.

★ **ALBERT R. TUCKER HAS BEEN** made West Coast manager of the Electrochemicals Department, E. I. du Pont de Nemours & Co., Inc. According to F. S. McGregor, the department's general manager, the expansion of activities in this region is being undertaken because of the

rapid pace of industrial development in California and the Pacific Northwest with consequent demands for various chemicals.

★ **MONSANTO CHEMICAL CO.**, St. Louis 4, Mo., has disclosed plans for the building of a \$450,000 unit to handle the production of Santocel at its Merrimac Division plant just outside Boston. Completion of the project is reported to be expected before the end of the year. It has also been announced that J. P. Skehan has been appointed to the position of assistant sales manager for sheet and Vupak materials at the Plastics Division, with headquarters at Springfield, Mass.

★ **INCREASED PRODUCTION** OF necessary items can be expected, it is reported, when the expansion plans of Santay Corp., Chicago, Ill., have reached completion, enlarging the firm's manufacturing facilities by more than two and one-half times.

★ **ROBERT ALLEN**, General manager of the Southwark Division, Baldwin Locomotive Works, Philadelphia 42, Pa., has announced the appointment of Frank M. Maly as sales manager for plastic presses.

★ **HERRESHOFF MFG. CO.**, Bristol, R. I., has announced the appointment of H. D. Thompson as superintendent of the plastics research, development and production division. Mr. Thompson was previously associated with Virginia-Lincoln Corp., Marion, Va.

★ **NEW DIRECTOR OF PUBLIC RELATIONS** for the SPI is Barrett L. Crandall who succeeds Albert Pfaltz.

★ **COLUMBIA PROTEKTOSITE CO.**, Inc., Carlstadt, N. J., and Plastic Art Toy Corp. of America have recently announced the opening of new showrooms and offices in the Empire State Bldg., New York City.

★ **DR. WILLIAM A. ZOBEL**, former research chemist with E. I. du Pont de Nemours & Co., Inc., and J. C. Hackney, former assistant professor of chemistry at Denison Univ., Granville, Ohio, have joined the staff of Battelle Institute, Columbus, Ohio, where they will be engaged in research in organic chemistry.

★ **HENRY M. RICHARDSON**, Consulting engineer of De Bell & Richardson, has moved his office and residence to Springfield, Mass., consolidating the offices of the firm with its laboratory. The new address of De Bell & Richardson is P. O. Box 240, Springfield, Mass.

★ **DR. J. P. T. BERLINGER**, Chemist, research engineer and physicist, has joined the firm of Engineering Associates, St. Charles, Ill. In his new position Dr.

Berlinger will continue development, begun at E. I. du Pont de Nemours & Co., Inc., in wood impregnation and molding.

★ **HARRY E. FOSTER HAS BEEN** appointed treasurer of B. F. Goodrich Chemical Co., Cleveland, Ohio, and assistant secretary of B. F. Goodrich Co., Akron, Ohio. Dr. T. L. Gresham and Dr. C. F. Gibbs have been named to new positions on the research staff of B. F. Goodrich Co. as directors of organic chemicals and polymerization research, respectively.

★ **THE INDUSTRIAL DEPARTMENT** of the Seattle Chamber of Commerce has been authorized by Reichhold Chemicals, Inc., Detroit 20, Mich., to announce plans for immediate construction of a Reichhold synthetic resin plant in Seattle, Wash. The plant, which will specialize in plywood adhesives and synthetic resins will be in operation by late Fall.

★ **THE APPOINTMENT OF EDWARD J. Maroney** as sales manager has been announced by U. S. Plywood Corp., New York 18, N. Y.

★ **RECENTLY ANNOUNCED BY** Denison Engineering Co., Columbus 16, Ohio, are the appointments of Lonnis Denison as vice-president and assistant general manager, Frank C. Norris as vice-president in charge of manufacturing and engineering, and E. L. Fouse as manager of expense control.

Sorry!

★ **WE REGRET THAT IN THE** article entitled "Honeycomb core in sandwich structure" which appeared on page 136 of the July issue, the sandwich structure was incorrectly described. The fuselage was built of Plaskon 911-11 resin and glass cloth laminate. No urea formaldehyde whatsoever was used in the construction.

★ **ON PAGE 225 OF THE AUGUST** issue, the advertisement for Anigraphic Process, Inc., should read: "Decorators on Glass and Plastic Containers since 1936."

RESTRICTIONS ON CONSTRUCTION materials have caused the postponement until early next year of Macy's "Preview of Tomorrow," the miniature World's Fair of American Industrial achievements and discoveries, tentatively scheduled for Sept. 4-30. Bert Bacharach of R. H. Macy & Co., New York, N. Y., promises that the project will be carried to a successful conclusion as soon as possible after January 1946.

BAKER PLASTICIZERS*

impart LOW TEMPERATURE Flexibility
TO
CALENDERED COMPOUNDS

VINYL RESINS

CELLULOSE RESINS

BUNA-S

BUNA-N

NEOPRENE

THE
BAKER CASTOR OIL COMPANY

ESTABLISHED 1857

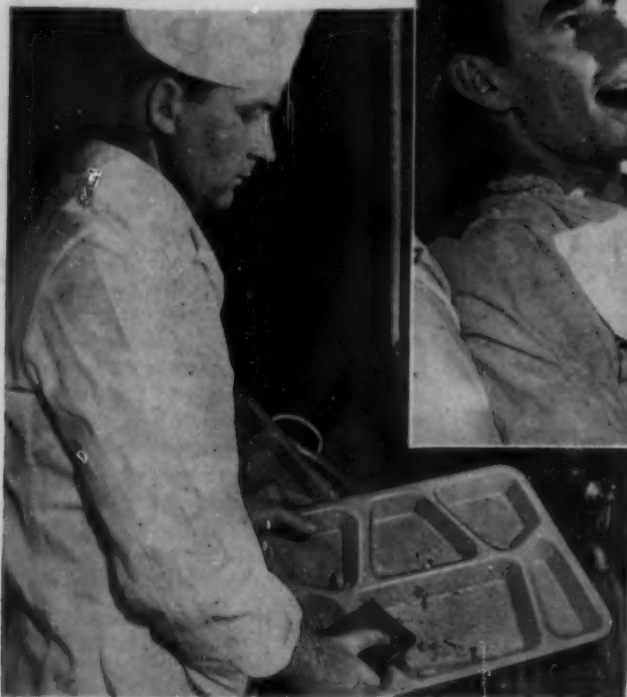
120 BROADWAY, NEW YORK 5, NEW YORK

Chicago, Illinois

Los Angeles, California

*CONTAIN NO PHTHALATE

"It's a real pleasure to wash plastic trays." The good opinion which KP's have of the molded melamine tray is echoed by soldiers in Army hospitals



PHOTOS, COURTESY AMERICAN CYANAMID CO.

WOUNDED American soldiers in all parts of the world are being served real American rations—the best that can be brought to them wherever they are—on compression-molded melamine mess trays. Divided into six compartments like the metal trays which they are replacing in most field hospitals, on hospital ships and trains operated by the Army's Medical Department, the trays have proved that they can stand the rough usage of Army kitchens as well as metal trays, and that they are preferred by the soldiers.

More than a million of these trays have been procured for the Medical Department by the Quartermaster Corps, which worked closely with the material manufacturer and a New Jersey molder throughout the development period. Since that time other molders have been producing these trays.

The trays, which are light brown in color, are compression molded of phenol-modified melamine-formaldehyde resin. The filler is impregnated cotton cuttings, or short tails. According to the specifications, the trays must have a minimum thickness through any section of 0.125 inch. They are produced with a high luster, to facilitate cleaning; have no sharp corners in which food particles may lodge; and are readily cleaned.

In its search for a material suitable for these trays, the Army developed a severe boiling test which no tray will ever meet in actual use. The test provides for the immersion of a tray in boiling distilled water for 30 minutes. The tray is then removed and allowed to stand for an hour at room temperature. This cycle is repeated seven times to give a total of eight immersions in boiling water and eight coolings. Then the tray is left to stand for 48 hr. in air maintained at a temperature of 77° F. and a relative humidity of 50 percent. During this 48-hr. period the tray is supported face down,

Melamine trays for hospital use

along its short edges, the long axis being held at a 45° angle. At the end of this test, trays that show cracks, surface chalking or warping are rejected.

So that the convalescing fighter will not taste his dish along with his food, the Army has devised a stringent test for taste and odor. In this test, boiling water is poured into one or two of the compartments, which are then sealed by being covered with a weighted piece of glass. After 5 min., the glass is removed. Should there be an odor, the batch is rejected. As a double check on the wholesomeness of the trays, specifications provide that suppliers of the raw material must furnish the contracting officer with a photostatic copy of written evidence from the Office of the Surgeon General attesting to the lack of toxicity of the raw material.

Army tests have shown that the utilization of the tray for field use, in lieu of mess kits (meat cans, in Army parlance), is practicable and that soldiers participating in the tests preferred the plastic tray. Also, it was found that the plastic tray possessed better camouflage properties than the steel tray, and did not conduct heat so readily.

During the course of the tests five plastic and five steel trays were subjected to an expedited durability, or drop test. The trays were dropped from a height of 5 ft. onto concrete pavement so as to land repeatedly on one corner. Breakage of the plastic trays occurred at the corners on which they were dropped after approximately four drops. Cracking developed at these breaks but did not extend beyond the compartment adjacent to the broken corners. Steel trays eventually bent out of shape and could not be stacked.

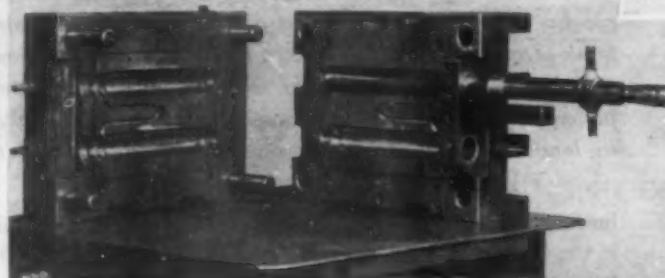
Credits—Material: Melmac. Molders include Bolta Rubber Co., Inc.; Chicago Molded Products Corp.; Eclipse Moulded Products Co.; Mack Molding Co.; and Plastimold, Inc.

Injection MOLDING

NUMBER NINE
OF A SERIES

Plastic molders are inclined to be skeptical about stories of wonderful moldings made on this machine or that, with 100 percent of the credit given to the machine. Molders and machine builders both realize that mold design and construction are at least half the story—and sometimes more.

The plastic product shown here is an excellent example of how a good mold and a good machine work together to produce



venience of the molder," said Mr. Wilson. "The ease with which the injection cylinder swings out for inspection or changing, for instance, and the heavy frame and toggle set-up. In general, the machine gives the molder confidence to undertake difficult jobs."

faultless moldings. It is a dehydrator tube for an automatic aircraft compass, made of black and transparent Lumarith by the Multi-Products Tool Company of Newark, N. J., on a six-ounce Lester injection molding machine.

Shown also is the mold used in making the transparent tube. It is ring gated, because the material must enter from one end, and is equipped with a water-cooled mandrel for either manual or automatic core pulling.

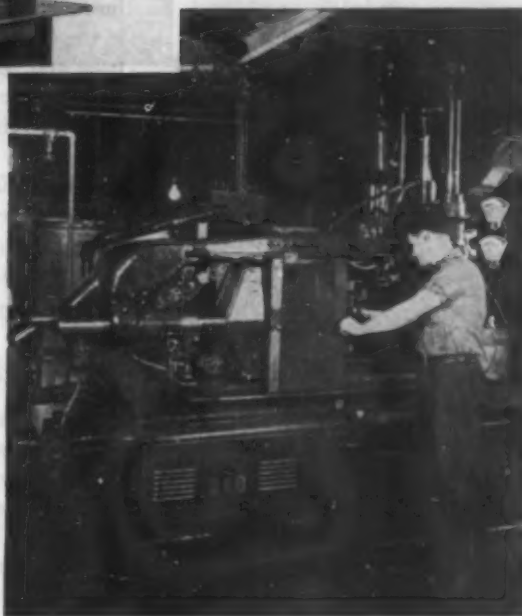
The tube is assembled and used exactly as it comes from the mold, without machining or polishing. Two factors make this possible: (1) the mold is chrome plated for both wearability and smoothness, and (2) the Lester patented injection cylinder plasticizes the material so thoroughly and injects it at such high applied pressure that fine surface luster is assured.

Despite the fact that the molding is made with a split thread, more than 200,000 tubes have been molded without flash and without the necessity of chasing the threads. Naturally the caps, which are molded with internal threads in a four-cavity mold, must go onto the tube with an air-tight fit.

Here again, proper mold design and proper machine design make possible the holding of close tolerances and the elimination of flash. The Lester beam-type alloy-steel frame and the Lester double-toggle mold closing mechanism provide the locking power necessary to resist injection pressure successfully, and assure sound, uniform moldings with a fine, dense micro-structure day after day, year in and year out.

A. J. J. A. Wilson, general manager of the Multi-Products Tool Co., has stated that many of his company's products can be made satisfactorily only on a Lester.

"The Lester offers more engineering features for utility and con-

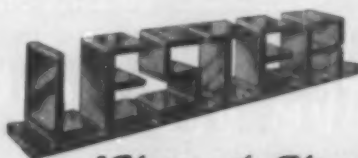


A Lester injection molding machine may be the answer to some of your tough molding jobs, too; may enable you to use plastic materials for parts which have been thought impossible to make by injection molding. Lesters are made in six capacities—4, 6, 8, 12, 16 and 22-ounce—with larger models in the engineering stage. If you would like to know more about their special features and production abilities, just drop us a line.

Injection Mold Design



Islyn Thomas, New York plastics consultant, has written two clear authoritative articles on the subject of injection mold design, planned to bring together the plastics customer, the sales engineer and the mold designer so that they may reach a better understanding of one another's problems. As a service to the industry we have reprinted these and offer them free to the readers of this magazine. Send for your copy today.



INJECTION MOLDING MACHINES

"Shaping the Things of Tomorrow"

National Distributors:

LESTER-PHOENIX, INC., 2711 Church Ave., Cleveland 13, Ohio

Irrigation tubes and soil conservation

by ARTHUR W. EMERSON*

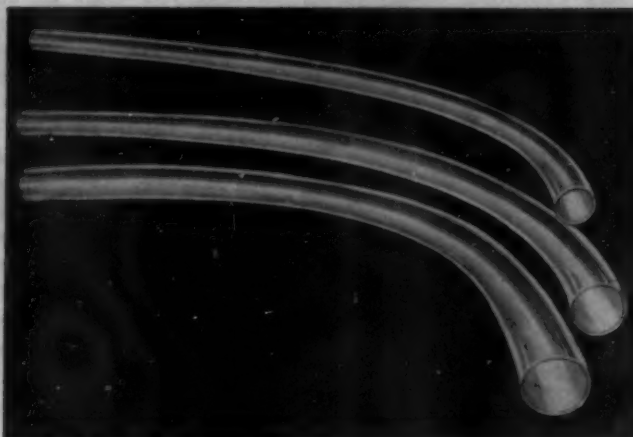


PHOTO: COUNTRY SOIL CONSERVATION SERVICE

"**P**LASTIC siphon tubes save labor, soil and water while irrigating" is the opinion of many farmers in the irrigated areas of the West. Plastic tubes are light in weight, can be placed in service quickly, and picked up from the one field when irrigation has been completed and carried or hauled to the next field. When using the tubes the farmer can grass down the permanent ditch banks for erosion and weed control. He can cut temporary field cross ditches and shorten up his runs. All of this means saving water, getting better plant growth, and saving time and labor.

Among the plastic materials used for these irrigation tubes are cellulose acetate butyrate, ethyl cellulose and high acetyl acetate. The most commonly used tubes range from 1 to 2 in. in diameter and are cut into lengths varying from 48 to 60 inches. Many have a wall thickness of 0.062 inch.

Really there are two ways of using these tubes. In the first, the tubes are laid through the supply ditch bank to the field ditch between the rows of growing crops. There are,



The problem of controlled irrigation is one which has caused farmers grave concern. Over-irrigation, resulting in such effects as are evident in Fig. 1, presents a constant menace to valuable crops. For this reason, plastic siphon tubes, bent so as to go over the water bank (Fig. 2) were developed to meter water to the growing plants. These tubes (Fig. 3) range from one to two inches in diameter and frequently measure 48 inches in length. Rate of flow is controllable to 10 percent

however, objections to this method. The tubes must be laid in the ditch bank by digging a trench at each row, placing the tube and refilling. Thus the tubes are more or less permanently placed for the season since it is a big job to move them. However, if the tubes are left all season, they interfere with cultivation.

The preferred method of using these plastic tubes is to bend them so they take irrigation water over the bank of a field lateral (Fig. 2), eliminating the necessity for cutting through these banks. Each section is bent so it forms an offset angle between 60 and 65 degrees, or an included angle of between 115 and 120 degrees. The shape of the ditch and the head of water may make slight variations in the angle for most efficient use.

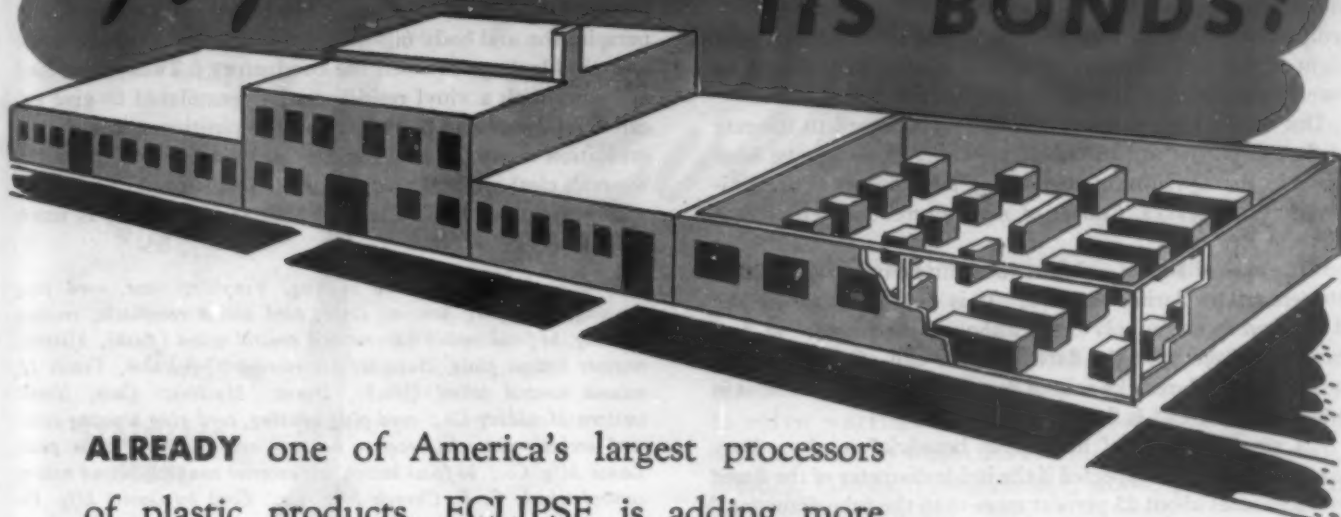
The use of plastic tubes for irrigating has several advantages. Some of these have been listed by the Agricultural Engineering Dept., University of Nebraska:

1. There is no heavy dirt work after the ditch is once made and no secondary ditch is needed. The plastic tubes are so light to carry and handle that a boy could easily change the sets. This should mean a big saving in time and labor.
2. It is possible to control the rate of flow in each row by moving the siphon tube in such a way as to raise or lower the discharge end.
3. When the rate of flow changes in the irrigation lateral it will raise or lower the water level which, in turn, will increase or decrease the rate of flow in each siphon tube. This means the siphons will automatically accommodate fluctuations in the rate of flow within certain limits. Where the rate of flow fluctuates it may be more feasible to use higher ditch banks and longer tubes.
4. Floating trash will not give much trouble with siphon tubes since the water is picked up below the surface.
5. The first cost is more than with other means of control—lath boxes, for example—but should be offset by longer life and saving in labor costs.

One of the most important practices influencing the yield per acre on irrigated land is the use that is made of the irrigation water. Over-irrigation results in a reduction of crop

* Chief, Regional Division of Information for Region 5, Soil Conservation Service.

Again ECLIPSE BURSTS ITS BONDS!



ALREADY one of America's largest processors of plastic products, ECLIPSE is adding more production space and facilities in order to serve current and future volume.

NEW AND LARGER equipment for Compression and Injection Moulding of all types of commercial and industrial plastics will enable ECLIPSE to deliver increased production of a wider range of products than ever before.

SOLVING problems in fabricating as well as moulding is a specialty at ECLIPSE. An impressive list of "firsts" in plastics assures you of the right answer to *your* production requirements — both today's and tomorrow's!

*Send us
your blue-
prints for
quotations*

Eclipse Moulded Products Company

5160 N. 32nd Street • Milwaukee 9, Wisconsin

PLASTIC PRODUCTS AND CUSTOM-MOULDERS FOR ALL INDUSTRIES

yields by causing excessive leaching of plant food, soil erosion, water logging of the soil, and the development of seepage and alkali (Fig. 1).

Observations of technicians in soil conservation districts are that the tubes have a most excellent future. They can be left in the field, exposed to high intensities of sun heat, without apparent adverse effects. They do not soften under high temperatures, nor do they become brittle when left out over night in freezing weather. For best results, they should be carefully stored in winter where they are not disturbed.

Due to the large number of inquiries in regard to the rate of flow of plastic siphon tubes, a number of tests have been made in the agricultural engineering laboratories of the University of Nebraska, College of Agriculture, and reported as follows:

"The rate of flow of a siphon tube can be increased at least 10 percent by flaring one end. It is desirable to have the flared end in the supply ditch although the increase in flow can be realized with the flare at either end of the tube. If both ends are flared the rate of flow is slightly more than it is when only one end is flared.

"A small amount of flare gives beneficial results. Very good results can be expected if the inside diameter of the flared end measures about 25 percent more than the tube diameter."

The future of plastics for tubes used in irrigation will, no doubt, develop a substantial volume depending on two factors—price and continued high quality.

Among the companies engaged in the extruding and distribution of these tubes are Detroit Macoid Co., Commercial Plastics Co., Extruded Plastics, Inc., Cozad Implement Co. and the Blackburn Auto Supply Co.

Fitting materials to the part

(Continued from page 132) phenolic are used in the molding of the volume control. This use of two materials is necessitated by the fact that the phenolic, which has a graphite content, is black and cannot be used with the flesh-colored melamine cases. The graphite in the plastic acts as a lubricant for the moving parts assembled to the instrument wheel and eliminates the need for any other lubricating which might have a tendency to foul the contacts after the instrument had been in continuous use.

Eight additional plastic parts

Also of melamine is the cord plug housing which is compression molded in a four-cavity die. Only a minimum amount of buffing and trimming is required to give this part the desired outward appearance. Another melamine compression molded part is the cord plug housing cover, molded in a 12-cavity die. Here again the sprue is easily broken off and leaves no flash. In contrast, the cord socket receptacle which is compression molded in an eight-cavity mold must be trimmed with a die. The melamine bi-focal switches are molded around a coated metal switch arm insert laid in the mold. The material for this part is preheated before being placed in the mold.

The bottom plate of the receiver is fabricated from a phenolic material. Phenolic was selected for this piece because of its good insulating qualities which are important at a point where the cords enter the instrument.

The air receiver cord pit is assembled from two parts—one injection molded of cellulose acetate butyrate in a 24-cavity die and the other of cellulose acetate. Since the butyrate is

soluble in acetate the pieces can be easily cemented together to form one homogeneous unit. This two-piece assembly is not only less liable to breakage but has remarkable dimensional stability.

In previous models produced by this company the receiver cord was covered with cotton insulation and wound with heavy black braid. The result was bulky and awkward, and perspiration and body oils leaked through the cotton to cause electrical leakage between the conductors. Today, the cord is coated with a vinyl resin specially formulated to give excellent resistance to body oils and perspiration. The coated insulation is smooth and flexible, and does not catch on the wearer's clothing. Moreover, since the resin can be extruded with extremely thin walls, the bulk of the wiring is much reduced.

Credits—Materials: Cord coating, Vinylite; case, cord plug housing, cord plug housing cover, cord socket receptacle, receiver housing, bi-focal switch volume and control wheel (flesh), Melmac, receiver bottom plate, Bakelite; air receiver connection, Tenite II; volume control wheel (black), Durez. Molders: Case, Northwestern Moulding Co.; cord plug housing, cord plug housing cover, cord socket receptacle, receiver housing and receiver bottom plate, Lance Mfg. Co.; bi-focal switch, air receiver connection and volume control wheel, C. F. Church Mfg. Co. Cord by Gavitt Mfg. Co. Instrument produced by Sonolone Corp.

Assembly glues

(Continued from page 158) ments which are as high as possible and which can be met by a sufficient number of glues to insure an adequate supply.

A complicating factor in the evaluation of the durability of glues is the presence of acidic or alkaline components in the glue which may cause a loss in strength of the glued joint. The deterioration in strength resulting from the presence of such ingredients may occur by one or a combination of the following mechanisms:

1. The components in the glue may attack and weaken the wood, thereby lowering the strength of the joint.
2. The components in the glue may deteriorate the glue itself, thereby lowering the strength of the joint.
3. A combination of (1) and (2).

A considerable amount of confusion has surrounded the question of such catalytic damage because the damage can occur by the several means noted above. In urea resin glues the factor of acidity is of more significance in its relationship to its effect on the glue than its effect on the wood. The more acid the urea glue, the more rapid the deterioration of the glue. Phenolic resin glues are relatively inert to acids which are generally used to catalyze their polymerization, but under certain conditions of sustained elevated temperature and moisture, the acid present in the glue will attack and weaken the wood. In both of these instances, acidity is a significant factor and causes a loss in strength of the glued joint, but it will be observed that the mechanism is quite different. It is important to note that despite the extreme acidity of the acid phenolics certain of them will yield wood joints which will be superior in aging properties to those obtained by using a urea assembly glue at a much higher pH.

Although conclusive data are lacking, it may be reasoned that excessive alkalinity in a glue may be as deleterious as excessive acidity. But again the type of glue involved must receive consideration. Casein, for example, is very alkaline—near the top of the pH scale—but the possibility of alkaline



It Holds Everything!

ALL of those so-different materials in that swing are bonded by *one* adhesive!

It's Pliobond . . . that revolutionary, new, quick-setting plastic adhesive . . . developed by American industry to solve wartime production problems. Pliobond solidly joins any materials . . . like or unlike . . . metals, plastics, fabrics, glass, rubber, wood, paper, plaster, leather, concrete, etc.

With Pliobond most applications need no high pressure or heat. For exceptional high shear strength, moderate pressure and 200-300°F. heat are sufficient.

Other important characteristics of this remarkable new adhesive: it's strong . . . permanent . . . withstands constant flexing . . . sets quickly . . . is immune to fungi . . . resists water, oils, and wax.

And Pliobond is always ready to go to work. Because it is a *one-part* bonding agent, there are no fussy mixtures . . . no exact weighing . . . no critical temperatures. It can be brushed, sprayed, spread or roller coated.

Don't these amazing features give you ideas toward solving production problems? Write us for full technical information on any application you have in mind.

Pliobond

BONDS ANYTHING TO ANYTHING!



UNITED STATES PLYWOOD CORPORATION

Exclusive Distributors

Industrial Adhesives Division: 55 West 44th Street, New York

Branches in Principal Cities

PLIOBOND® is a product of

THE GOODYEAR TIRE & RUBBER COMPANY

*Trademark registered, The Goodyear Tire & Rubber Company

[[Pliobond for Home use will soon be available at your neighborhood store]]

3500 Plastics Patents

A WEALTH of technical information about plastics has been made available to American manufacturers, chemists and research workers by the publication of abstracts of more than 45,000 alien patents now controlled by the Government. More than 3500 of these U. S. patents relate to plastics. They were issued to inventors in Germany, Italy, Japan and other enemy and enemy-occupied countries prior to the war. Most of them have now been made available for use by Americans on a non-royalty, non-exclusive license basis.

In the mechanical patents, those related to plastics cover such operations as molding, milling, rolling, laminating, impregnating, die casting, vulcanizing, fiber forming, and film and foil making. The chemical patents cover a very wide range of products and processes including glyptal-alkyd, phenol-aldehyde, urea-aldehyde and other condensation products; polymers and copolymers such as the linear polymers and polyamid vinyl resins; and numerous types of treated natural products such as rosin shellac, cellulose derivatives, casein, zein, soybean proteins, coumarones and lignin plastics. Decorative and protective coatings, adhesives and solvents are also covered in this group.

The field of synthetic rubbers is well covered by numerous patents grouped together in the APC files under the name "elastomers." This title covers such products as diolefin polymers, chloroprene, buna and butyl rubbers, and thiokol, as well as natural products such as latex, balata and gutta percha.

Abstracts of all of the vested patents are offered for sale by the Alien Property Custodian at nominal prices. These abstracts are available in two different categories—chemical patents and non-chemical (mechanical) patents. In the chemical group those inventions relating to Plastics, Synthetic Resins, Plasticizers and Solvents are found in Section 23 (Parts I and II) of the Alien Property Custodian abstracts, and those relating to Elastomers are found in Section 24. Each of these sections contains abstracts of several hundred patents and each is priced at \$1.00.

The non-chemical patents are abstracted by U. S. Patent Office classes. Those relating to plastics are:

Class	Title
18	Plastics
23	Chemistry
91	Coating
106	Plastic compositions
117	Coating processes and miscellaneous products
154	Laminated fabric manufacturers
204	Chemistry, electrical and wave energy
260	Chemistry, carbon compounds

The price of each class of abstracts in this group is 10¢, and orders for these or the chemical abstracts may be sent to the Office of Alien Property Custodian, Field Building, Chicago 3, Ill. Complete sets of abstracts as well as copies of all vested patents are available for examination in the following APC Patent Libraries:

Washington, D. C., National Press Bldg., 14th and F Streets; Chicago 3, Ill., Field Building, 135 S. La-Salle Street; New York 5, N. Y., 120 Broadway; Portland 8, Ore., 301 Guardian Building; Boston 8, Mass., 17 Court Street.

Further information may be obtained from the Office of the Alien Property Custodian, National Press Bldg., 14th and F Sts., Washington, D. C., or any APC office.

attack on the wood can be disregarded for the reason that the glue *itself* would probably deteriorate before weakening of the wood could be observed. Phenolic glues of varying alkalinity offer a more selective means of determining the effect of alkaline catalysts on the strength of wood because these glues have the inherent ability to withstand the severe conditions of elevated temperature and humidity.

Data relating to the effect of pH on the strength of wood are contained in Tables I and II. Table II also lists typical strength values for urea, casein, phenolic and resorcinol glues.

A factor which has received more attention in Great Britain than in this country is the performance of an assembly glue in wood joints wherein the glue line is abnormally thick. A situation of this kind occurs when ill-fitting wood members are joined together. While it is a debatable question whether an assembly glue should be required to have "gap-filling" characteristics for aircraft use, it has been found that joints prepared with the phenolics, resorcinol and certain of the especially modified area resins, having a glue line thickness of $1/32$ to $1/16$ in., will retain their shear strength after being subjected to artificial aging. Casein and typical urea resin glues are notably deficient in this characteristic. Casein glue fails because of its shrinkage; typical urea resin glues fail because of their susceptibility to crazing upon aging. Table III contains data on glued wood joints wherein the glue thickness is between $1/32$ and $1/16$ inch. It is to be noted that these data refer to joints subjected to shear. Data are not available which would indicate how such joints would behave in pure tension.

Aside from durability considerations, an aircraft assembly glue must have following working characteristics:

1. Stability in storage.
2. Water solubility when mixed.
3. A reasonable working life when mixed.
4. A practicable assembly period.
5. Short clamping intervals.
6. Absence of odor.
7. Absence of dermatitis-inducing characteristics.

These characteristics are summarized in Table IV for casein urea, phenolic and resorcinol glues.

Undoubtedly, the new glues and gluing techniques which have been developed during this war will have an impact upon the eventual peacetime wood-fabricating industry. Many factories which had been engaged in the manufacture of furniture, boats and miscellaneous wood products before the war have had new experiences with the higher grade glues as a result of production of articles of war. It may be anticipated that when peace finally comes, wood fabricators will have a new attitude toward quality and durability.

Acknowledgment

Thanks are due to Dr. G. M. Kline and R. C. Rinker, Bureau of Standards, for their cooperation in arriving at the data contained in Table I, and to Richard Sandburg, N.A.E.S., for his assistance in the preparation of the tabular data.

Variations in tensile strength

(Continued from page 155)

Miscellaneous materials—The strength of the paper-base lignin materials was reduced about the same in percentage as the paper phenolic laminate. The polyvinyl-formal impregnated birch did not drop off in strength as much as the phenolic impregnated maple. The comparative resin contents are not known, however.

(Continued on next page)

For Over 50 Years DESIGNERS AND BUILDERS OF -

- Mills
- Refiners
- Crackers
- Mixers
- Washers
- Calenders
- Tubing Machines
- Large Molds
- Pot Heaters
- Vulcanizers
- Autoclaves
- Hydraulic Presses
- Multi-Platen Presses
- Automatic Curing Presses
- Belt Curing Presses
- Compression Molding Presses
- Plywood Presses
- Auxiliary Equipment

FOR THE RUBBER, PLASTICS AND PLYWOOD INDUSTRIES

Adamson research has presented the industries it serves with many outstanding processes and improvements in basic manufacturing equipment. Designing processes and building machinery to meet special or unusual requirements has been the business of Adamson engineers for half a century.

Solution of problems arising from today's

amazing development in rubber and synthetic resins may be confidently entrusted to their knowhow and experience. Consult them while your plans for development are still in the blueprint stage. Their advice and cooperation may not only help solve many vexing process and production problems, but assure you definite competitive advantages in the post-war market as well.



Recent reorganization and expansion have added to Adamson's highly specialized engineering service and production facilities, the combined research and engineering abilities of United Engineering and Foundry Company plus the manufacturing capacity of their five great plants.



ADAMSON UNITED C O M P A N Y

AKRON, OHIO

SUBSIDIARY OF UNITED ENGINEERING AND FOUNDRY COMPANY

The World's Largest Designers and Makers of Rails and Rolling Mill Equipment

Plants at PITTSBURGH • VANDERGRIFT • NEW CASTLE • YOUNGSTOWN • CANTON

Affiliates: Davy and United Engineering Company, Ltd., Sheffield, England

Dominion Engineering Works, Ltd., Montreal, P. Q., Canada

General—The types of fractures of the materials with relatively low elongation were similar at all temperatures. Those materials which decreased markedly in elongation with temperature, of course, showed less necking down and stretching at low temperatures. In the case of cellulose acetate, the material exhibited a brittle fracture and shattering at -38°F .

Bibliography

- ¹ T. T. Oberg, R. T. Schwartz and D. A. Shinn, "Mechanical Properties of Plastic Materials at Normal and Subnormal Temperatures," Army Air Forces Technical Report No. 4648 (June 6, 1941); MODERN PLASTICS 20, 87 (Apr. 1943).
- ² T. S. Carswell, D. Telfair and R. U. Haslanger, "Influence of Temperature on the Mechanical Properties of Molded Phenolic Materials," Proceedings A.S.T.M. 42, 944 (1942); MODERN PLASTICS 19, 65 (July 1942).
- ³ R. Nitsche and E. Salewski, "Effect of Temperature on the Strength of Plastics," Kunststoffe 29, 209 (1939).
- ⁴ R. Nitsche and E. Salewski, "Effect of Temperature on the Impact Strength of Plastics," Kunststoffe 31, 381 (1941).
- ⁵ D. A. Shinn, "Impact Data for Plastic Materials at Various Temperatures," Army Air Forces Technical Report No. 5012 (August 9, 1943); MODERN PLASTICS 22, 145-52, 184, 186 (July 1945).
- ⁶ P. M. Field, "Basic Physical Properties of Laminates," MODERN PLASTICS 20, 91 (Aug. 1943).
- ⁷ W. F. Bartoe, "Service-Temperature Flow Characteristics of Thermoplastics," MODERN PLASTICS 17, 47 (Mar. 1940); Mech. Eng. 61, 892 (Dec. 1939).
- ⁸ T. S. Carswell, R. F. Hayes and H. K. Nason, "Physical Properties of Polystyrene as Influenced by Temperature," Industrial and Engineering Chemistry 34, 454 (1942).
- ⁹ P. M. Field, "Impact Strength of Reinforced Thermosetting Plastic Materials," Navy Department, Bureau of Aeronautics, Report No. AMS(M)-654 (Jan. 11, 1943); MODERN PLASTICS 21, 123 (Apr. 1944).
- ¹⁰ J. Delmonte and W. Dewar, "Factors Influencing Creep and Cold Flow of Plastics," A.S.T.M. Bulletin No. 112, 35 (Oct. 1941); MODERN PLASTICS 19, 73 (Oct. 1941).
- ¹¹ John Delmonte, "Shear Strength of Molded Plastics," A.S.T.M. Bulletin No. 114, 25 (Jan. 1942); MODERN PLASTICS 19, 63 (Sept. 1941).
- ¹² F. B. Fuller, "Engineering Properties of Plastics," MODERN PLASTICS 20, 95 (June 1943).
- ¹³ J. S. Rinehart, "Temperature Dependence of Young's Modulus and Internal Friction of Lucite and Karolith," J. of Applied Physics 12, 811 (Nov. 1941).
- ¹⁴ S. S. Kistler, "Thermoplastic Behavior of Linear and Three-Dimensional Polymers," J. of Applied Physics 11, 769 (Dec. 1940).
- ¹⁵ W. C. Wall, "Design Information on Lucite," Aero Digest 41, 122 (Oct. 1942).
- ¹⁶ "Effect of Temperature on Certain Mechanical Properties of High-Strength, Cross-Laminated Paper Plastic (Papreg)," Forest Products Laboratory Mimeograph No. 1321 (May 1943).
- ¹⁷ W. Mehndora, "Synthetic Resin Molded Materials and Other Plastics," Second Enlarged Edition, V.D.I. Press, Berlin, pp. 59-62, 258 (1939).
- ¹⁸ R. Houwink, "Elasticity, Plasticity and Structure of Matter," Cambridge University Press, Cambridge, pp. 34, 155 (1940).
- ¹⁹ "Lucite Aircraft Manual," E. I. du Pont de Nemours and Co., Inc., Arlington, N. J. (Nov. 1942).
- ²⁰ "Plexiglas Technical Data; No. 2, Mechanical Properties," Rohm and Haas Co., Philadelphia, Pa. (July 1943).
- ²¹ "Lumarith in Aircraft, Technical Data Section," Celanese Plastics Corp., New York, N. Y. (1943).
- ²² "Technical Data on Plastic Materials," Plastic Materials Manufacturers' Association, Washington, D. C. (May 1943).

Phenolic molding materials

(Continued from page 143)

Shrinkage

Pieces molded from phenolic materials undergo a very slight shrinkage in the mold, and a somewhat larger shrinkage after ejection from the mold and while the piece is cooling.

The very small shrinkage during molding is due to the polymerization taking place. It is usually of negligible importance in so far as final dimensions are concerned. The shrinkage on cooling is due in part to the chemical reaction still in progress while the piece is hot, but is also partly a thermal effect and similar to the contraction on cooling exhibited by most solids. It is greater in amount and less uniform than in the case of metals.

TABLE III.—AVERAGE SHRINKAGE VALUES FOR VARIOUS TYPICAL PHENOLIC MATERIALS

Type	Shrinkage in. per in.
High resin content	0.009 -0.015
Woodflour-filled	0.006 -0.008
Mineral-filled	0.0035-0.0045
Fabric-filled	0.003 -0.004

In so far as can be determined by laboratory study, shrinkage in phenolic materials is a complex function of all of the variables listed below:

- a. Amount of resin used
- b. Plasticity (i.e., degree of polymerization of the resin)
- c. Nature of the filler
- d. Moisture content
- e. Difference between mold temperature and room temperature
- f. Cure time
- g. Molding pressure

Because of the complexity of the relationship and the number of variables involved, no general mathematical formula can be found to express the value of this property. For material of a given composition and plasticity, the shrinkage will be found to depend primarily on molding conditions—temperature, pressure and cure time (Table III).

The shrinkage of a material must be known when designing a mold in which it is to be used; allowance must be made for this shrinkage.

Specific gravity

Specific gravity is another property of the material to which experienced molders give close attention. As previously stated, this is, strictly speaking, a property of the material in molded form, not to be confused with apparent density of the loose molding powder.

Specific gravity is controlled by the filler used in the material and, to a lesser extent, by the molding pressure used in forming the piece—the higher the molding pressure applied and the more completely the latter is confined within the mold, the denser and more compact the piece will be. The type of filler used is much more important in determining specific gravity, since in most cases the molding pressure used is sufficient to produce pieces having the maximum specific gravity possible with the given material.

The average specific gravity of phenolic materials with woodflour filler is 1.35 to 1.39. When asbestos or other mineral filler is used in combination with woodflour, the specific gravity is higher. When asbestos is used as the whole filler, the specific gravity is on the order of 1.8.

Specific gravity is important to the molder because he buys the molding material by the pound but sells the finished molded parts at a certain price per piece, or per hundred or thousand pieces. It is distinctly to his advantage, therefore, whether he is molding large individual pieces or a large quantity of small parts, to use a material which will give him the lowest weight per piece and the maximum number of pieces per pound of material used.

This is true where no special physical or chemical properties are required in the molded piece. However, in special cases, where such properties as improved heat resistance or chemical resistance are required, it is necessary to use asbestos or other special mineral fillers in the molding material.



METAL drawn steel.
Spotlight application.
5½" height, 3" diameter.

PLASTIC injection
molded of ethyl cellulose.
Single shot. 5½" height, 4" diameter.
Vapor light handle.

Complete service
**PLASTIC MOLDING
METAL STAMPING
PLASTIC *with* METAL**



America's largest Industries are benefiting by our experience in both Plastic Molding and Metal Stamping. The METAL SPECIALTY CO. offers you this unique service combination. Our alert experienced Engineering and Designing staff keeps abreast of the rapid changes in material and production methods, for both Metal Fabricating and Plastic Molding.

PLASTIC MOLDING DIVISION . . . All thermoplastics from a fraction of an ounce up through 18 ounces per shot.

METAL FABRICATING DIVISION . . . In all heavy and new light metals. Drawing, Coining, Stamping, Welding, Rolling, Forming.

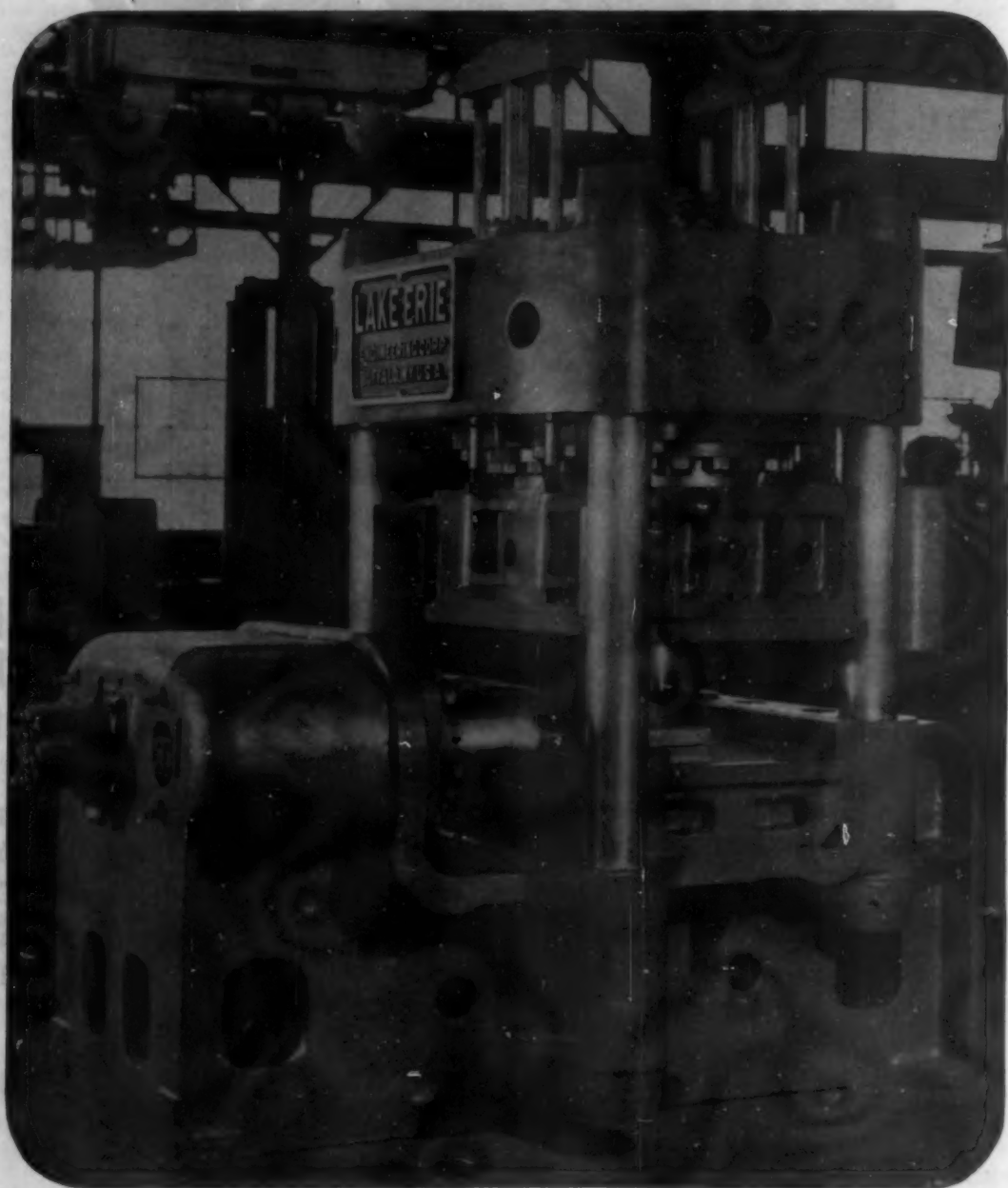


THE METAL SPECIALTY CO
**PLASTIC MOLDING
METAL STAMPING**

ESTE AVE. • CINCINNATI 32 • OHIO

BRANCH PLANT — SOUTH L ST., RICHMOND, IND.
SALES OFFICE — W. GRAND BLVD., DETROIT, MICH.

Another Lake Erie contribution to better compression molding



This 450-ton Lake Erie angle molding press was designed and built to meet the customer's specific requirements. It is used by a large electrical manufacturing company for molding phenolic material.

Lake Erie has a thorough knowledge of all types and sizes of hydraulic presses required by the rapidly growing plastics industry.

Already we have designed standard compression molding presses that can be adapted to your needs—or we can build presses to meet any special production methods you may require. Write for complete information.

LAKE ERIE ENGINEERING CORP.
868 Woodward Avenue
Buffalo 17, N. Y.

LAKE-ERIE
ENGINEERING CORP.
BUFFALO, N.Y. U.S.A.

The RED EYED MIRROR



that saves lives



THIS signalling mirror can be aimed without any additional instruments at a target eight miles away!

For the first time, Army and Navy personnel have a fool-proof, accurate instrument with an aiming mechanism for flashing positions to searching boats and aircraft. It is expected that this mirror will save many lives.

This new CRUVER war job represents a solid year of development work. The mirror of tempered glass is encased in a molded acetate housing. The person using the mirror looks through the center hole. When the sun hits the mirror, the aimer sees a red spot wherever the reflection of sunlight is thrown. Thus, by aiming the red spot, he is accurately directing the rays of the sun at his objective as far away as eight miles. The entire job is sturdy enough to stand a drop of six feet onto hardwood floor.

The instruction card is printed on white acetate, laminated with a transparent acetate sheet so that the printing is permanently resistant to salt water and weather conditions. The mirror has, of course, undergone and passed strenuous tests of humidity, corrosion, weather and drop resistance.

The latest in CRUVER'S war contributions is further proof of the fine plastics development and manufacturing service available from this organization.



Cruver

MANUFACTURING COMPANY

2456 W. Jackson Blvd., Chicago, Ill.—Seeley 1300

NEW YORK
2 West 46th St.
Wisconsin 7-3847

WASHINGTON
Hotel Washington
Met. 5-900, Ext. 650

DETROIT
General Motors Bldg.
Madison 8263

DOW

leading producer of Polystyrene

*presents***STYRON 411****Improvements**

With this announcement of the Styron 411 series, Dow presents a new, improved polystyrene formulation thoroughly tested in actual use. Easier handling and better moldability reduce rejects—produce greater yield than ever. Check These Advances:

BETTER FLOW—Produces improved surfaces free from flow marks . . . fills thinner sections.

MOLD RELEASE—No lubrication of molds required—releases easily—does not drag.

WELD STRENGTH—Styron 411C welds better—produces high strength welds.

MACHINEABILITY—Lubricating effect reduces drag on tools—cuts down frictional heat, hence fewer rejects.

FINISHING—Bufts well with reduced tendency to scuff and "burn." Better trimming produces higher yield.

Price

As the pioneer producer of polystyrene, Dow has consistently improved materials, enlarged production and passed on the benefits of low price to the plastics industry. In keeping with this policy, Styron 411C, in the several types, will be offered to the trade at no advance in price.

Availability

Styron 411C is immediately available from Dow exclusively. Civilian uses of Dow Polystyrene are now authorized in limited quantities. Essential war uses still come first. Complete details on the Styron 411 series are available on request. Write to the Plastics Division or any sales office.

Let's work it out together

Success in plastics is not a one-man nor even a one-industry job. It calls for the cooperation and combined skill of manufacturer or designer plus fabricator plus raw materials producer. Working together, this team saves time and money and puts plastics to work successfully. Call us—we'll do our part.

THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland • Detroit • Chicago
St. Louis • Houston • San Francisco • Los Angeles • Seattle

**DOW
PLASTICS**

STYRON • ETHOCEL • ETHOCEL SHEETING
STYRALOY • SARAN • SARAN FILM • STRIPCOAT



When Consolidated originally developed the transfer mold for this intricate Terminal Block (illustration A), provision was made for a multiplicity of threaded brass inserts—and while it meant no trouble for us to add two more inserts for the projecting switch stops . . . trouble did occur in actual service; it was difficult for the brass stops to maintain their functional accuracy.

As Accuracy Headquarters, this problem became Consolidated's problem! . . . And in illustration (B) you now see the solution . . . plastic stops . . . integrally molded, to closest tolerance, right into the piece. According to customer's reports, this change proved eminently satisfactory!

We cite this as an example of Consolidated's flexibility. Our know-how with mold design, mold making and processing is such as to permit changes—incorporate improvements—and thus assure perfect performance.

The above is also indicative of Consolidated's desire to serve. Inquiries invited from those whose present problems or plans have reached the thinking-out stage. Consolidated guarantees your blueprint in plastic—the right plastic!

INJECTION
molding
TRANSFER
molding
COMPRESSION
molding

"YOUR BLUEPRINT
IN PLASTIC"



Consolidated

MOLDED PRODUCTS Corporation
309 CHERRY STREET, SCRANTON 2, PA.

Branches: NEW YORK • CHICAGO • DETROIT • BRIDGEPORT • CLEVELAND

Put your plans for peacetime
products through the

Par-Ka-Scope

find the
"FASTENING BUGS" NOW
avoid
COSTLY CHANGES LATER



LENS of the "Par-Ka-Scope" is the eagle eye of a Parker-Kalon Assembly Engineer. He can help you focus on the "fastening bugs" that usually hide out until you are all set up for production, then start running up costs.

THE "BUGS" may be needless tapping, slow bolt-and-nut assembly, costly inserts in plastics that slow up molding, riveting in hard-to-reach places. Whatever they are, he'll help you find them now, when a changeover to the short-cut fastening method . . . with P-K Self-tap-

ping Screws . . . requires only a little pencil work.

SAVINGS OF 30% to 50% are the common experience of thousands of manufacturers who have adopted this short cut method of assembling metals or plastics.

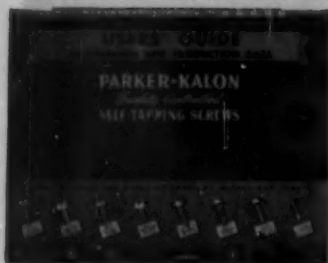
THE P-K ASSEMBLY ENGINEER'S advice is unbiased. He'll recommend only the best Self-tapping Screw for the job - Parker-Kalon makes *all* types. Tell us when you'd like him to call, or send details of fastening jobs for recommendations.



THIS MANUFACTURER FOUND A MILLION "TAPPING BUGS"... FIND YOURS NOW!

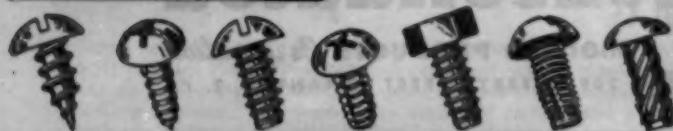
By switching to P-K Type "U" Drive Screws in assembly of Hexacon Soldering Irons, the Hexacon Electric Co., Roselle, N. J., eliminated a million tapping operations a year formerly needed for machine screws. Time saving is more than 25%. Fastening is better, stronger than when machine screws (and before that, taper pins) were used.

In application (B), the heads of the Type "U" P-K Screws are ground off after they are driven, making a permanent, tamper-proof fastening.



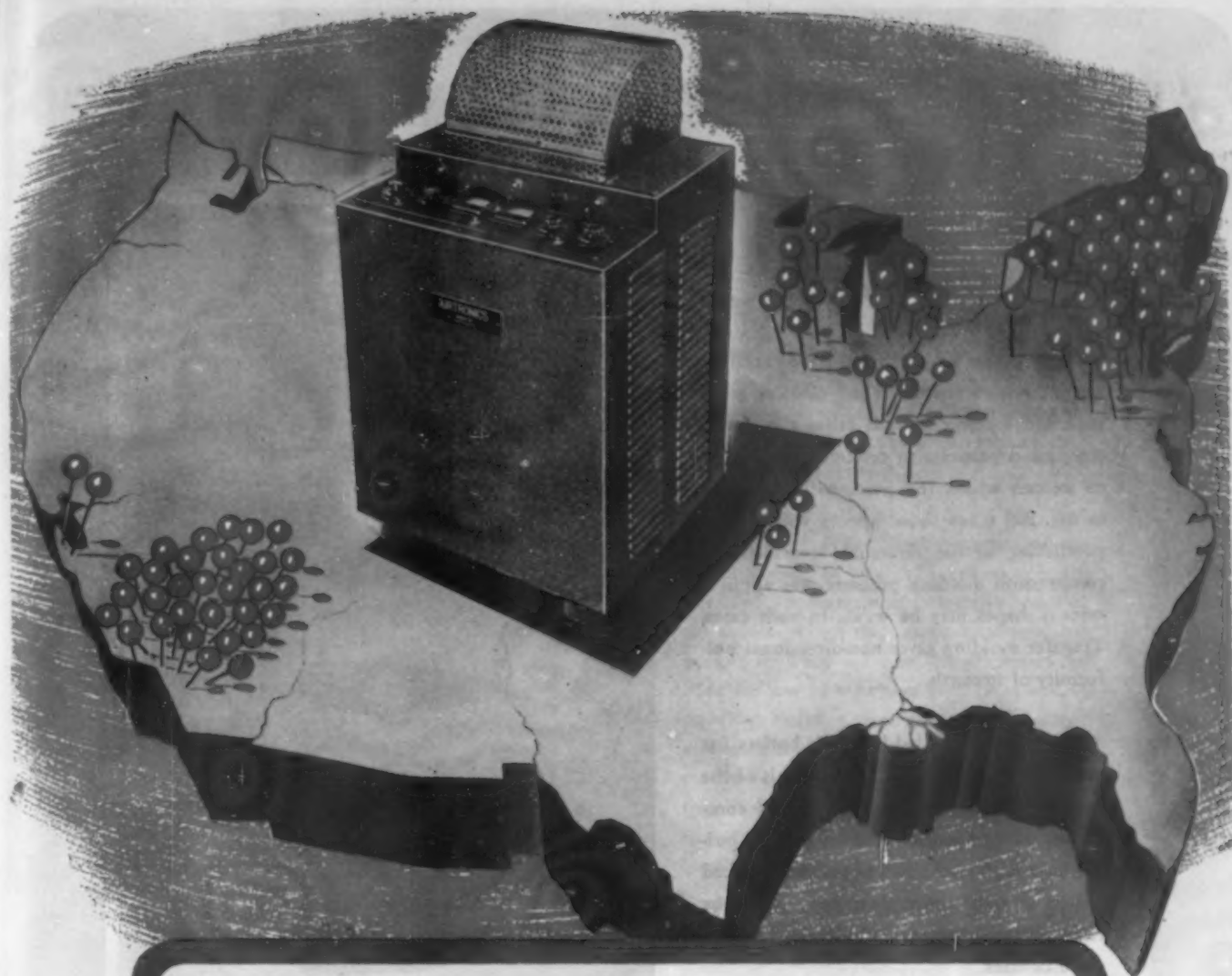
GET THIS GUIDE-IT'S FREE

The P-K "Users' Guide" describes all types of Parker-Kalon Self-tapping Screws, and tells where and how to use them. Arranged so you can find the facts you need quickly. Write for it, Parker-Kalon Corp., 208 Varick St., New York 14, N. Y.



PARKER-KALON
Quality-Controlled
SELF-TAPPING SCREWS

For Every Metal and Plastic Assembly



More and More Leading Molders Specify AIRTRONICS

Today, from coast to coast, AIRTRONICS Preheaters are serving the leaders of the plastics molding industry. Part of the story behind this nationwide acceptance lies in AIRTRONICS' unique design features, such as Automatic Tuning, Dual Load Selection, and Automatic Power Regulation which bring to molders the *practical* means of obtaining *all* of the production advantages of electronic preheating.

The rest of the story lies in the competent technical advice and prompt service available to all users. You are invited to contact the AIRTRONICS sales-engineer in your area for advice on your particular preheating problem. There is no obligation.



Airtronics MANUFACTURING CO.

LOS ANGELES
5245 W. San Fernando Rd.
Zone 26

CHICAGO
407 S. Dearborn
Zone 5

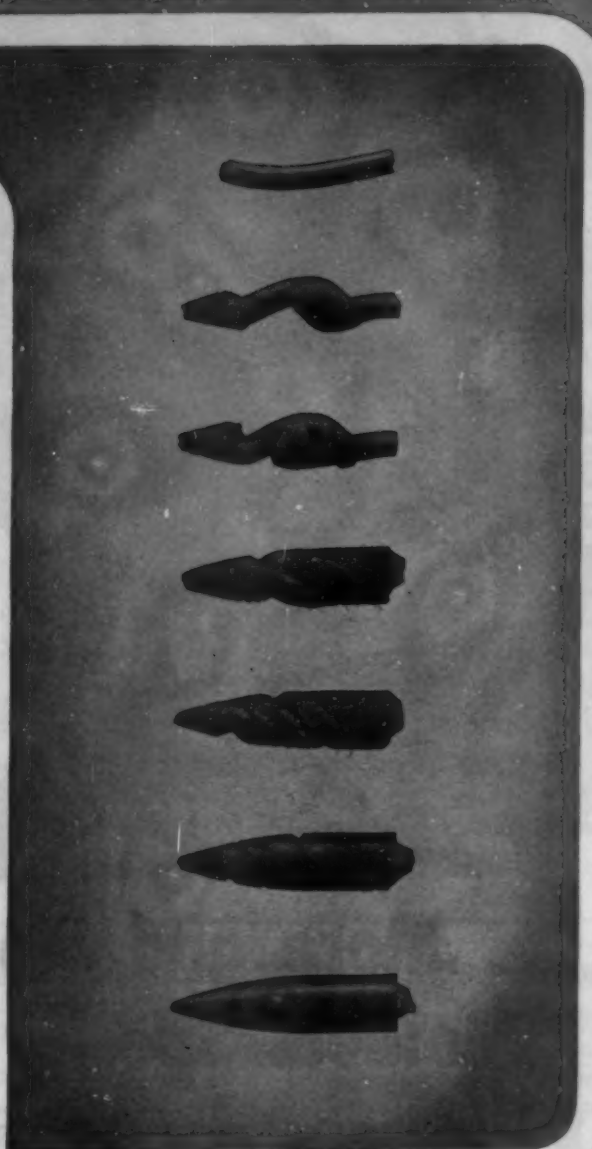
NEW YORK
31-28 Queens Blvd.
Long Island City
Zone 1

WHY TRANSFER MOLDING GIVES UNIFORM STRENGTH

Compression molded parts have excellent strength characteristics when molding pressure and loading method cause the plastic compound particles to orient in opposition to stresses which the parts will encounter in use. But when those stresses will be perpendicular to the direction in which the compression molding pressure was applied, certain shapes may be weak. In such cases, Transfer molding gives non-directional uniformity of strength.

Compression molded frangible bullets, for example, break too easily—as a result of the stratification that occurs as the mold compresses the compound. Transfer molded bullets have high strength. The partially formed bullets at right show what happens as the fully plasticized compound fills the Transfer mold cavities.

The entering ribbon goes to the bottom of the cavity, forming a helical coil as the cavity fills. Air and gas rise to the parting line and escape at the vents, insuring full density at the conical tip. Helical orientation of the compound eliminates stratification and assures uniformly high strength.



SHAW INSULATOR COMPANY

160 COIT STREET IRVINGTON 11, N. J.



LITERATURE IS AVAILABLE AS FOLLOWS:

A list of nearby licensees who can offer you the advantages of the patented Transfer molding process.

Two bulletins on "Why Transfer Molding Is Economical," Bulletins on "Why Transfer Molding Gives Fine Inserts," "Why Transfer Molding Improves Appearance," "Why Transfer Molding Permits Better Holes," and "Why Transfer Molding Permits Variable Walls."

Most plastic processes are used by Shaw and the Plax Corporation, Hartford 5, Conn. Both companies offer unbiased help in plastics applications. For the names of nearby licensed Transfer molders and for literature listed above... write Shaw.

NEW USES FOR PLAX POLYFLEX SHEETS



Plax Polyflex* Sheet is thin, polystyrene sheet—oriented in two directions. This orientation produces flexibility and toughness yet retains polystyrene's excellent electrical and chemical characteristics.

Introduced by Plax early in the war, demand for Polyflex Sheet has required the multiplication of original production facilities. The photograph at left shows some of the uses to which this unusual material has been put. They include strips formed by Plax for use in a storage battery assembly; punched Polyflex used for storage battery retainer plates; spiral wound tubing which, cut into cylinders, is used for a special electrical insulating purpose; and washers and spacers stamped and punched for high frequency electronic insulation.

Normally stocked in water-clear, natural polystyrene color, Polyflex Sheet can be produced in colors covering the spectrum, through jet black. Normally stocked in rolls from 12" to 20" wide and 500' long, it is also supplied in rolls slit to customer specifications. Thicknesses range from .001" to .020", with six sizes in between.

Complete data may be obtained by writing Plax.

*T. M. Reg. U. S. Pat. Off.

LITERATURE IS AVAILABLE AS FOLLOWS:

An illustrated folder on "Extrusion Blowing of Thermoplastics" and a bulletin on "Plax Plastic Blown Products." Several "how to" bulletins on Plax polystyrene products, listing all polystyrene characteristics. A bulletin on "New Special Plastic Shapes by Plax." Bulletins on Plax Cellulose Acetate, Cellulose Acetate Butyrate, Methacrylate and Polyethylene products.

Styramic, polydichlorstyrene, and ethyl cellulose are among the other materials offered by Plax in a variety of forms. Engineering help covering nearly all plastics materials and methods is available from Plax and the Shaw Insulator Company, Irvington 11, N. J. For literature listed above . . . write Plax.

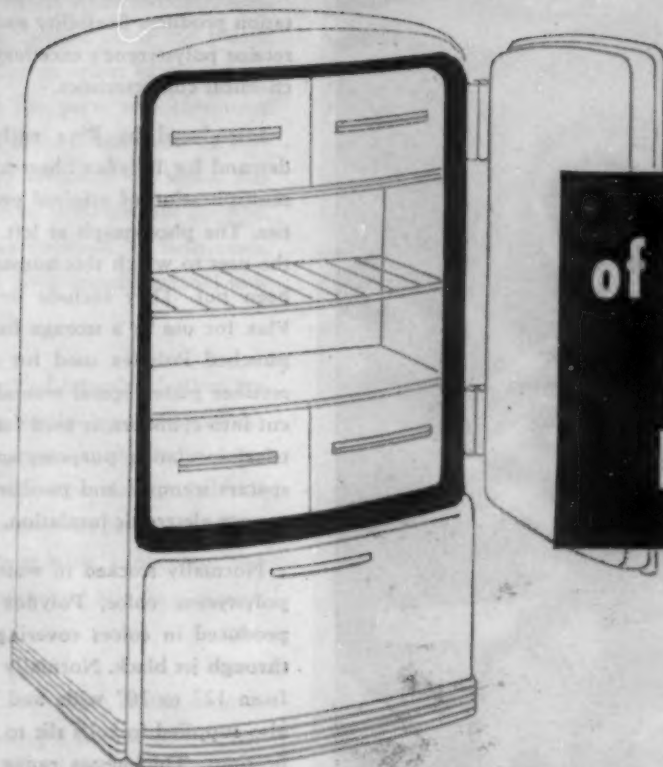


133 WALNUT STREET ★ HARTFORD 5, CONNECTICUT

WORLD'S LARGEST PRODUCER OF SYNTHETIC RESINS



For faster production



**of high or low
pressure
laminates**

No. 5021

PLYOPHEN

Here is an odorless phenolic laminating varnish curing as fast as 3 minutes with sheets .16 of an inch thick . . . adaptable to either high or low pressure molding . . . imparting excellent water resistance and exceptional mechanical strength . . . and thor-

oughly proved in war use. Its uses are endless. For example, it is unsurpassed for such products as refrigerator breaker strips and door liners. Write to the Sales Department at Detroit for details of this versatile varnish.

Saturday Evenings at 8:30 (E.W.T.)
You Will Enjoy RCI's
"Symphony of the Americas"
Via Mutual Network Stations



REICHOLD CHEMICALS, INC.

General Offices and Main Plant, Detroit 20, Michigan

Other Plants: Brooklyn, New York • Elizabeth, New Jersey • South San Francisco, California • Tuscaloosa, Alabama • Liverpool, England • Sydney, Australia
SYNTHETIC RESINS • CHEMICAL COLORS • INDUSTRIAL PLASTICS • INDUSTRIAL CHEMICALS

WE SPECIALIZE IN PLASTIC MOLDINGS OF ALL KINDS



★ **Standard's** research staff and engineers are constantly working out new assignments that take in all types of plastic fabrication. Radio knobs, refrigerator cold compartment doors, automobile instrument panels, lipstick containers . . . these suggest the endless variety of Standard molded plastics.

★
For successful handling of your particular plastics molding work, contact Standard.



Largest in the World

Standard's equipment includes:

- ★ Three of the world's largest plastic injection molding presses.
- ★ Complete setup for compression and transfer molding of thermo setting plastics.
- ★ A new conversion of standard 8 oz. injection molding machines of particular value in the production of small parts for the electronic and allied industries where close tolerances must be held.

THE STANDARD PRODUCTS CO.

Administrative and Sales Offices, 503 Boulevard Bldg.
Woodward Avenue at E. Grand Boulevard, Detroit 2, Mich.

Here's why

R. D. Wood STEAM PLATENS are favored for precision work

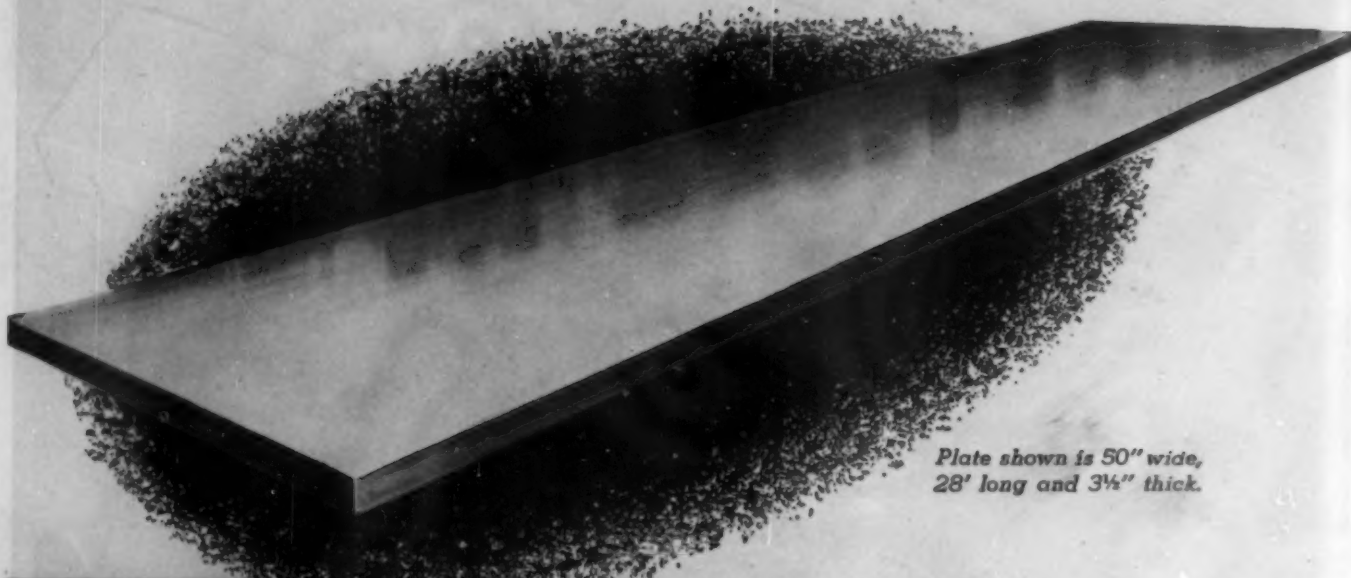


Plate shown is 50" wide, 28' long and 3 1/4" thick.



Rigidly located drill heads ensure parallel holes on true center line of plate.

UNIFORM HEAT DISTRIBUTION . . .

on R. D. Wood platens, holes are drilled on a special horizontal multiple-spindle drill press that insures straightness, accurate center-line location and uniform spacing.

ACCURATELY-MACHINED SURFACES . . .

platens regularly furnished with surfaces parallel to within .003", regardless of size. For presses of extreme accuracy, parallelism maintained within .0015" or less. Surface can be finished as required from ordinary smooth tool finish to a highly polished surface.

PERMANENTLY STEAM-TIGHT . . .

Wood's welded strip or plug construction remains permanently leak-proof under the most severe operating conditions.

R. D. Wood's facilities for and experience in steam platen construction covers units of every practical size, shape and thickness, for use in the rubber, plastic, wallboard and many other fields. Write us today outlining your problems.

HYDRAULIC PRESSES AND VALVES FOR EVERY PURPOSE



EST. 1803

R. D. WOOD CO.

PUBLIC LEDGER BUILDING
INDEPENDENCE SQUARE
PHILADELPHIA 5, PA.

WANT 50,000 TWINS...ALL ALIKE?



● Right now, identical twins of molded plastics are rolling off our machines by the thousands, all earmarked for the military services, where uniformity is of prime importance.

In the postwar tomorrow, General Industries will once again be able to offer you the experience and equipment that will mold your plastic parts, efficiently and economically, the last piece as accurate as the first.

From blueprint to finished product, manufacture will be speeded by experienced engineers. For instance, we can offer slight changes in design that will improve the moldability of the product. Ingenious mold makers realize the utmost importance of accurately-placed inserts, close

tolerances and finish to meet the most critical specifications. Skillful operators, working with modern equipment, will turn out any quantity of identical pieces that will work smoothly and efficiently in your finished products.

General Industries is among the top capacity molders of America. Our combination of skilled experience, fine craftsmanship and adequate machinery can help mold salability into your postwar products.

THE GENERAL INDUSTRIES COMPANY

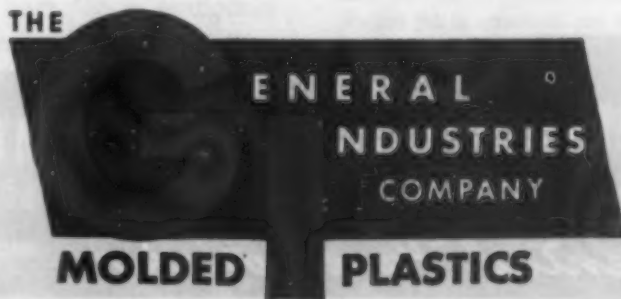
Molded Plastics Division • Elyria, Ohio

Chicago: Phone Central 8431

Milwaukee: Phone Daly 8818

Detroit: Phone Madison 2146

Philadelphia: Phone Camden 2215



“Mosinee” KEY TO MANY MARKETS



MOSINEE, the “proved-in-service” material for products and packaging, provides advantages that open the way to many markets . . . for MOSINEE can be engineered to include definite essential paper properties: dielectric strength — uniform density — tensile strength — pliability — water repellency — controlled acidity and alkalinity — or other technical characteristics that might add outstanding value to your products.

More and more, product engineering is taking into consideration the advanced potentials of MOSINEE. Through cooperation with the “paperologists” of The Mills of Mosinee, many manufacturers and converters have improved the quality of their products, broadened utility, lowered cost, expanded present markets and opened new ones.

The Mosinee laboratories, efficient production facilities, and paper engineering leadership are prepared to cooperate in creating specific types of MOSINEE for your products, or in improving your processing.



MOSINEE PAPER MILLS COMPANY
MOSINEE WISCONSIN

Essential Paper Makers

Please address
your letter
“Attention Dept. A”

Here
Allie
tract
and c
Each
to the
from
the s
of de
mous
Allie
ings t
ticabl
the ad



Ready for Your Business

Here is only a handful of the kind of cold forgings Allied is ready to make by the million for trucks, tractors, automobiles, refrigerators, rolling stock and other peacetime machines.

Each forging of each type is exactly alike, even to the finest tolerances. Cold forged in one piece from coiled steel wire or bars, each embodies the strength, precise dimensions and flexibility of design that make dependable quality synonymous with the Allied name.

Allied knows when the tremendous material savings that can result from cold forgings are practicable and how to effect them . . . and when the added strength of cold-forged parts can con-

tribute to an end-product or a manufacturing operation. Find out just *how* ready Allied cold forgings are for *your* business. Send in your blueprints . . . or write to Allied today.

★ ★ ★

"IT'S AN ALLIED PRODUCT." In its four plants—two in Detroit and two in Hillsdale, Michigan—Allied makes special cold-forged parts, standard cap screws, etc.; hardened and precision ground parts; sheet metal dies (from the largest to the smallest); R-B Interchangeable Punches and Dies; jigs, fixtures, steam-heated plastic molds and special production tools.

ALLIED PRODUCTS

C O R P O R A T I O N

Department 27, 4622 Lawton Avenue, Detroit 8, Michigan

WE BUY, SELL, PROCESS

PLASTICS SCRAP

ACETATE

BUTYRATE

VINYLS

POLYSTYRENE

ACRYLICS

H. MUEHLSTEIN & Co. INC.

122 EAST 42nd STREET, NEW YORK 17, N. Y.

LOS ANGELES: 1431 E. 14th St. - MEMPHIS: 45 W. Wingfield Ave. - CHICAGO: 187 S. La Salle St. - AKRON: 250 Jewett St. - BOSTON: 31 St. James Ave.

PLASTIC MOLDS

25 years experience in designing and building molds for leading molders.

Our plant is modern in equipment for producing the best in molds. Compression, Injection, Transfer.



FORTNEY MFG. CO.

247 N.J. R.R. Ave.
NEWARK 5, N. J.

DECORATORS ON GLASS AND
PLASTIC CONTAINERS SINCE 1936



4 colors in 1 operation
—finest detail

ANIGRAPHIC PROCESS INC.

11 BROADWAY NEW YORK 4, N. Y. WHItEhAll 3-5253

NEW COMBINATION PRESS

FOR TRANSFER MOLDING

FOR COMPRESSION MOLDING

Stokes now offers a highly efficient dual-purpose press, readily converted either to transfer or compression molding, at a cost only slightly greater than that of a conventional compression press alone.

Single power unit has greater capacity to provide the high mold-closing speed and high ram speed necessary to work most efficiently with induction or electronically heated preforms in transfer molding. By simply closing a pressure valve, transfer cylinder is cut out and the press is ready for compression molding. All advantages of Stokes "Standard" compression molding presses are combined with the following additional features for transfer work:

- Exclusive toggle-action for closing and locking mold shut.
- Low hydraulic pressure . . . low maintenance cost.
- Completely self-contained—one power unit.
- No floating platen.
- Choice of two methods of loading.
- Low initial cost.

For full details and specifications of this dual-purpose press, write . . .

F. J. STOKES MACHINE COMPANY
5934 Taber Road Philadelphia 20, Pa.

50th year of Service to Industry

F.J. Stokes

MOLDING EQUIPMENT





IMMEDIATELY AVAILABLE FROM STOCK

Developed after much experimenting and testing, these ejector pins will meet a recognized need among plastic mold makers. Made of nitralloy, steel heat treated for maximum core toughness, ground and polished, then nitrided—with heads of soft steel welded on—these pins provide the exact physical properties you have been wanting, to eliminate some of your difficulties.

Send for DME News which gives detailed information with diagrams and sizes.

DME

**DETROIT MOLD
ENGINEERING COMPANY**

6686 E. McNICHOLS RD.

DETROIT 12, MICHIGAN

Get Easier Cutting and Longer Saw-Life

ON MAGNESIUM, ALUMINUM, PLASTICS, HARD WOOD



...use
SIMONDS
 New "Skip-Tooth"
 Hard Edge
 Metal Band Saws

Soft materials like the light metals, plastics and wood all turn up extra-large chips when cut. So saws used in this type of cutting need extra-large gullets to clear these big chips...saws like Simonds Skip-Tooth Band Saws. This type of saw has coarse teeth... 2, 3, 4 and 6 per inch...yet the gullet is shaped so that even the narrower blades have maximum strength in the body, the teeth only being hardened. So you can bank on it that these new Skip-Tooth Saws will stay sharp so long that you'll get your money out of them long before they dull... which means you can economically replace with new blades and cut out all sharpening costs. See your dealer or write direct to Simonds.

BRANCH OFFICES: 1350 Columbia Rd., Boston 27, Mass.; 127 S. Green St., Chicago 7, Ill.; 228 First St., San Francisco 5, California; 311 S. W. First Ave., Portland 4, Ore.; 31 W. Trent Ave., Spokane 8, Wash.; 416 W. 8th St., Los Angeles 14, Calif.

Cut the War Short, BUY WAR BONDS

SIMONDS
SAW AND STEEL CO.
 FITCHBURG, MASSACHUSETTS

ORGANIC PEROXIDES

CATALYSTS FOR POLYMERIZATIONS
DRYING ACCELERATORS • OXIDATION
AGENTS • BLEACHING AGENTS

LUCIDOL
(BENZOYL PEROXIDE)

LUPERCO
(PEROXIDE COMPOUNDS)

ALPEROX C
(TECHNICAL LAUROYL PEROXIDE)

LUPEROX
(PEROXIDE PASTES)

Special Organic Peroxides

* REGISTERED



TRADEMARK

LUCIDOL CORPORATION

BUFFALO (5) N. Y.



**KEEPING A FINGER
ON YOUR Plastic PULSE!**

• We're carrying a capacity load right now . . . but we can still find a spare "finger" to keep constantly on the nation's plastic pulse. • For 25 years, Larry Cook has been "growing up" with plastics, so that today he places at your complete disposal a wealth of plastic knowledge covering all phases of design, engineering and manufacturing. • Write Larry Cook about your plastic plans. No obligation, of course.

LAWRENCE H. COOK, INC.

Manufacturers of Plastic Molds & Tools
65 Massasoit Ave., East Providence 14, R. I.

SERVING

THE PLASTICS INDUSTRY

Our 35 year reputation for reliability, personal service and quality precision workmanship is your guarantee of satisfaction.

STEEL STAMPS AND DIES

Precision graduating stamps and dies of carefully hardened high test steel for maximum production on plastics. Trademarks, ornaments, designs, engravings in molds.

MASTER HUBS AND HUBBING

For plastic molds where uniformity and multiple production are required. Specially treated for hardness and polished to a high lustre surface.



TAPS

Standards and specials. Ground from solid hardened high-speed steel blanks. Specially heat treated and with extra high finish for plastic production. Accuracy guaranteed.



PLASTIC MOLDS • STEEL STAMPS AND TAPS

SOSSNER

181 GRAND STREET, NEW YORK 10
or 27 BROADWAY, LYNBROOK, N. Y.

A DIFFICULT PROBLEM LICKED BY

K & J

The Job—

Large size, irregular shape, variable thickness—it looked like a tough job, and it was!

The Result—

Smooth-surfaced, flawless—finished couplings with a minimum flash, that passed rigid inspection tests 100%.



*Here's a concern to bear in mind
for your future molding problems*

KUHN & JACOB MOLDING & TOOL CO.

1200 SOUTHARD STREET, TRENTON 8, N. J.
TELEPHONE TRENTON 9391

Plastic Molding

Sales Representatives: NEW YORK—S. C. Ullman, 55 W. 42nd St.
NEW ENGLAND—Wm. T. Wyler, 204 Lordship Road, Stratford, Conn.

PHILADELPHIA—Towle & Son Co., 18 W. Chelton Ave. Bldg.



A complete line of Precision plasticizers to meet the requirements of all types of plastics compounding . . . Our laboratory will assist in determining the plasticizer best suited to your compounding problems. Write for complete data

RESINS and PLASTICIZERS

*Produced Under Precision Controls
for Exacting Plastics Production . . .*

PICCOLASTIC

Modified Styrene Resins in a wide range of molecular weights, melting points and solvencies. In combination with each other or with other plastic bodies make possible the creation of results hitherto unattainable

PICCOLYTE..

Hydro-Carbon Terpene Resins chemically inert, acid and alkali resisting, compatible with all rubbers, coal tar residues, pitches, paraffins and waxes. Clear color permanence . . .

PICCOUMARON

Para Coumarone Indene Resins. Offered in light and dark color in a wide range of melting points . . .

STANDARD  *Chemical Company*
General Offices AKRON 8, OHIO

IS THERE
NO END
TO THIS

PLASTIC BUSINESS?

• Naturally! Plastic has limits just as there are limits to steel, aluminum and other materials which must combine malleability with strength.

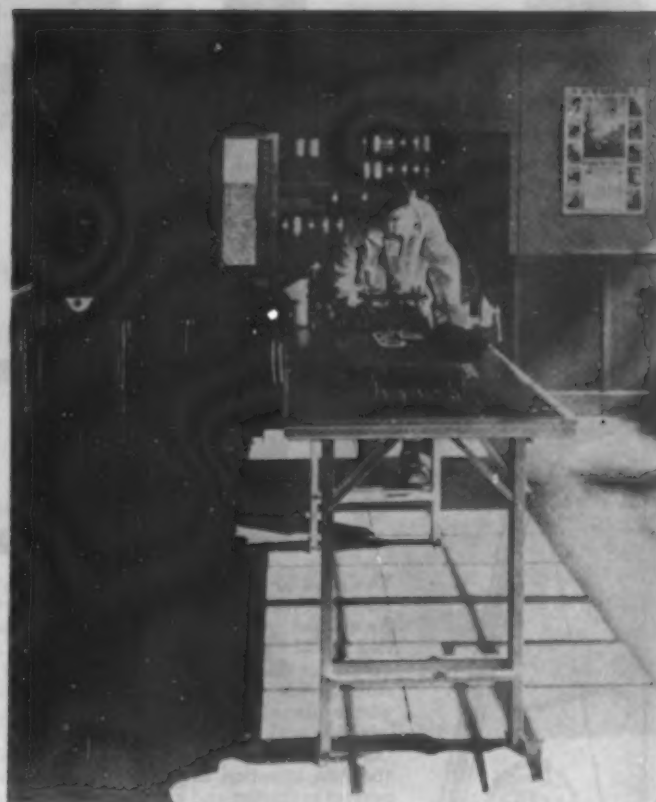
If it's possible in plastics, however, you can depend upon the experience, engineering skill and facilities of Continental Plastics Corporation to give your products the display value and eye appeal—the power, punch and protection to “put them over” in the toughest competition.

NOW is the time to bring or send in your blueprints or sample product for postwar plastic plans.



CONTINENTAL
PLASTICS CORPORATION

308 WEST ERIE STREET
CHICAGO 10, ILL.



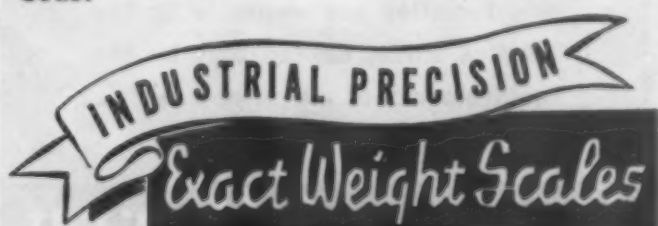
Technician at work in testing laboratory of the Reynolds Molded Plastics plant, Cambridge, Ohio, U. S. A.

Scientific Testing Laboratory Uses Exact Weight Scales

Reynold's, one of the oldest and best known plastics manufacturers, maintains a complete laboratory for testing and checking parts to determine whether their customers get exactly what was ordered. This work is done with chemicals and precision equipment by technicians to be certain that all parts meet the most detailed of chemical and engineering specifications.

Sales
&
Service
from
Coast
to
Coast

EXACT WEIGHT Scales play an important part in this work. The part is either right or wrong and since weighing is a mechanical operation there is no guesswork. We are proud of the fact that our equipment is used . . . proud too that EXACT WEIGHT Scales are and have been used in all plastics operations for many years.



THE EXACT WEIGHT SCALE COMPANY

650 W. FIFTH AVE.

COLUMBUS 8, OHIO

Dept. AC, 783 Yonge St.

Toronto, Canada

ACCURATE

The road to conversion may be months away or may be just around the corner . . . but leading American manufacturers are not waiting to be told "ITS HERE" each day brings new requests for ACCURATE compression and transfer mold advice . . . ACCURATE facilities are offered where plans are complete or where tough problems are still to be solved . . . there is NO OBLIGATION for this service . . . ACCURATE assures absolute attention to specific specifications . . . perfect precision and a close watch on production costs . . . try us!

ACCURATE MOLDING CORPORATION 132 NASSAU STREET
BROOKLYN, N. Y.

COTTON DUCKS

for

Laminators and Molders

Our Southern mills have made high-tensile cotton fabrics for the Plastics Industry for fifteen years and specialty industrial cotton textiles for over thirty-five years. Our experienced development and production facilities are available to the Plastics trade, limited only by the requirements of our armed forces.

Curran & Barry

320 BROADWAY

NEW YORK CITY

Have YOU Considered ALLYL ALCOHOL and ALLYL CHLORIDE

as raw materials for the synthesis of Polymerizable substances?

We have had the opportunity of working with many manufacturers of PLASTIC MATERIALS who are studying the possibilities in this field thoroughly. We are glad to offer YOU experimental quantities of these new chemicals and to supply general technical information regarding properties and uses.

Enlarge production facilities, which will permit lower prices on both ALLYL ALCOHOL and ALLYL CHLORIDE, are being built. Now is a good time to get YOUR ALLYL program under way.

Selling Agents for
SHELL CHEMICAL
Division of
SHELL UNION OIL CORPORATION

R.W. GREEFF & CO.

10 ROCKEFELLER PLAZA
NEW YORK CITY

TRIBUNE TOWER
CHICAGO, ILL.

VARCUM

PHENOL

CH₂O

RESINS

VARCUM

PHENOL

RESINS

VAR

*Do you eat on a
TABLE CLOTH or a CLOTH TABLE?*



ESINS

VARCUM

Yes, sir, now table tops that are harder than ordinary wood are produced by the yard and you probably have eaten from a CLOTH TABLE in many of the nation's leading restaurants. This strange phenomenon that transforms soft, pliable cloth, paper and other bases into super hard panels that resist soil, wear, stain and strain, is accomplished with the use of VARCUM 2686.

This is an alcohol soluble, heat hardening varnish and after the cloth or paper is coated the strips are laminated into panels that can be used for practical building or manufacturing purposes or for decoration of interiors. By this process

with fancy or wood grained paper or colorful cloth, many unusual effects can be obtained. Top sheets of panels, when impregnated with Varcum 2686 before molding, shows fast molding characteristics at high or low pressure and good color retention when exposed to sunlight. Available with the following properties: Solids—70%, Alcohol—30%, Viscosity—2000, 3000 centipoises.

WANT SAMPLES?

We will be glad to send you generous samples of VARCUM VARNISH 2686 if you desire. Just write us on your company letterhead.

VARCUM
CHEMICAL CORPORATION
NIAGARA FALLS, NEW YORK

VARCUM

VARCUM

CH₂O

RESINS

VARCUM

PHENOL

CH₂O

RESINS



CIBANITE

A
SPECIALIZED PLASTIC
FOR INDUSTRIAL AND
ELECTRICAL USES

ANILINE

FORMALDEHYDE
RESIN

THERMOPLASTIC
MOLDING POWDER



HIGH DIELECTRIC VALUE
HIGH TENSILE STRENGTH - LOW LOSS FACTOR
LOW WATER ABSORPTION
EXCEPTIONAL ELECTRIC STABILITY
GOOD MACHINING PROPERTIES

Literature available on request

CIBA PRODUCTS CORP., 77 River St., Hoboken, N. J.

INORGANIC PIGMENTS

for plastics



INSOLUBLE

HEAT AND LIGHT RESISTANT

*Let us know the application . . .
Color samples supplied on request.*

WRITE

B. F. DRAKENFELD & CO., INC.
45-47 Park Place, New York 7, N. Y.

Drakenfeld

*A molder
you may rely on*

If you are looking for a molder who will operate as an integral part of your production—almost like a department of your own plant—whose schedules will mesh with yours, whose production standards are as high as you require—then you may be interested in our compression molding service. Some of the finest names in American industry are numbered among our clients.



KENILWORTH PLASTIC MOLDING COMPANY

Division of Eureka Button Co. (Est. 1885)

KENILWORTH, NEW JERSEY

Branch Offices: I. L. Arkin Co. 43 E. Ohio St., Chicago 11, Ill.
Sabo-Gray Sales Organization 2970 W. Grand Blvd., Detroit 6, Mich.

are **7** heads
better than **1**?



**VICTORY'S* Engineering
Staff and 6 Consulting Engineers
work together . . . to give you
BETTER MOLDED PLASTICS!**

If your post-war product demands injection molding to closest tolerances (like those required in the work we are now doing for the Armed Forces), you'll find VICTORY* completely equipped to do a better job quickly, and at the lowest possible

cost consistent with finest craftsmanship. Now is the time to plan with our engineers and their consultants, so that your problems can be solved *before* you are ready to market your product.

**AUTOMATIC
INJECTION MOLDING**
Small and large parts
**UP TO 17-OZ.
SHOTS**

Lumarith, Tenite, Fibestos,
Plastacelle, Crystallite, Lucite,
Ethyl Cellulose, Polystyrene,
Lustron, Styron,
Cellulose Acetate and
others . . . all molded to your
exacting specifications.

Member
Society of the
Plastics Industry



***VICTORY
MANUFACTURING COMPANY**

1722 W. Arcade Place, Chicago 12, Ill.
ESTABLISHED 1930

**PLASTICS and
LIGHT METALS
CUT FASTER, EASIER**



with
BARNES

BAND SAWS

. . . produced in Barnes' modern plant devoted exclusively to the manufacture of saws for over a quarter century.

ARC-LINE . . . for
contour, die-cutting
and similar operations.

**HARD EDGE FLEX-
IBLE BACK . . .** for
general all-purpose cut-
ting.

SKIP TOOTH . . .
high speed sawing
of plastics, soft non-fer-
rous metals, wood, etc.

SPRING TEMPER...
for aluminum, thin
tubing, etc.

Whatever the material to be cut, there's a Barnes Band Saw designed and made for the job. These saws are really tough . . . they have everything it takes to do the cutting operation faster, easier, more efficiently. All Barnes band saws are skillfully

welded to provide perfectly aligned and uniform weld. Depend upon Barnes Band Saws—they're built to give longer and more efficient cutting service.

Call your Mill Supply Distributor—
he carries a complete stock of all
Barnes Band Saws.



ESTABLISHED 1919

W. O. BARNES CO., INC.

DETROIT 14, MICHIGAN

LOW-COST



Helmet

Liner

Scrap

This Molding Compound

offers remarkable economy in phenol-formaldehyde plastics. By all means let us give you the whole story, as this material is a genuinely important opportunity for molders of MANY types of articles. Ample supply available.

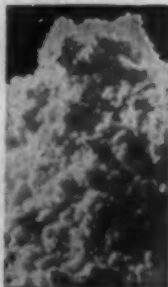
Request Working Sample

Rayco Cotton Fillers

FILFLOC Pure cotton flock of surprising cleanliness and uniformity.

FABRIFIL Macerated cotton fabric for extra strength.

CORDFIL Evenly cut lengths of tire cord for plastics of utmost strength.



RAYCO

Fillers

RAYON PROCESSING CO., INC.

*Developed and Produced by
Rayco Fillers for Plastics*

60 Tremont St., Central Falls, R. I.

INVESTIGATE!

CANADA

When Making Postwar Plans

The National Income of Canada in 1944 was approximately 9 billion dollars and Canada now ranks among the first five exporting nations of the world. American business men who contemplate establishing plants or agencies in Canada may obtain pertinent data from:

THE BANK OF TORONTO

Incorporated 1855

Head Office — Toronto, Canada

3 Dimensional ART IN PLASTICS

—is the ultimate in modern plastics—better known as Crystal Seal. It is a process, patented by the Gits Molding Corporation, that presents a totally enclosed, three dimensional effect of crystal beauty unlike any other plastic creation. Name plates, dials, trim, insignia, counter displays, trade marks, medallions, emblems, signs, escutcheons, plaques, buttons, ornaments, containers, stationery and desk products, game pieces, handles, knobs, drawer pulls, door plates, etc., result in increased value and eye appeal with the Crystal Seal process. Qualified Molders are being licensed under Patent No. 2,354,857. Infringers will be vigorously prosecuted.



GITS
Molding Corporation

4614 West Huron Street, Chicago 44, Illinois

Manufacturers of the famous Gits Flashlights, Knives, Savings Banks, Games, Protect-o-shields, Switchplates, etc.

Canadian Distributor:

Kahn, Bald & Laddon, Ltd., 69 York St., Toronto

PLEXIGLAS GRANULATED ON BALL & JEWELL GRINDERS IN ROHM & HAAS PLANT

Photograph shows installation of single #1½ Ball & Jewell machine, one of many used for granulating Plexiglas into powders useful for molding and extruding.

Rohm & Haas Company, leading plastic manufacturer, uses Ball & Jewell grinders to perform this most important function. Other raw materials manufacturers in plastics likewise depend on Ball & Jewell for standard equipment. Many molders and extruders use similar equipment for re-grinding scrap into moldable powders.

Write for prices, FREE catalog of 13 models.

BALL and JEWELL

20 Franklin Street, BROOKLYN, N. Y.

Since 1895, Manufacturers of Patent Rotary Cutters

or get in touch with nearest representative

CHICAGO: Neff Kohlbusch & Bissel. DETROIT: J. C. Austerberry's Sons. LOS ANGELES: Moore Machinery Co. LOS ANGELES & SAN FRANCISCO: Machinery Sales Co. NEW ENGLAND: Standard Tool Co., Leominster, Mass. ATLANTA, GA.: George L. Berry. ST. LOUIS: Lannimore Sales Co. SEATTLE & WASHINGTON: Olympic Supply Co. KANSAS CITY, KANS.: Fluid Air Engineering Co. AUSTRALIA and NEW ZEALAND: Scott & Holladay Pty., Ltd., SYDNEY STOCKHOLM, SWEDEN: Ingenjorsfirman Teknova. CANADA: Williams & Wilson, Ltd., Toronto & Montreal, Canada. HAWAIIAN ISLANDS: Hawaiian Sales Service, P. O. Box 3498, Honolulu 11, T. H.



This is #9 in a series of advertisements showing typical Ball & Jewell scrap grinder installations in the plastics industry.

Big News on MOLDED INSERTS

Lakone today is molding single units that contain multiple inserts of complex size, form and dimensions. Millions of precision pieces ranging from 1/4" to 2" are serving as auxiliary parts in wartime instruments and mechanisms . . . That's "big news" because Lakone has perfected a new, *exclusive* technique for handling large runs of small parts—the answer to difficult insert-assembly problems of the past . . . "Lakone-mold" offers complete service from master-made molds to micrometric finish parts . . . Orders accepted NOW for on-time delivery. Send blueprints for estimate. Samples on request.

PLASTIC PARTS by COMPRESSION: All types of Thermosetting Materials: Bakelite, Resinox, Durez.

by INJECTION: Styrene, Cellulose, Acetate, Butyrate, Polythene, Ethocel, Tenite, etc.

★

Phone **LAKONE** - Mold

THE LAKONE COMPANY
500 RATHBONE AVENUE
AURORA, ILLINOIS

Cumberland Scrap Grinders

Study the Simplicity of this Post-war Model!

DESIGNED specifically for granulating plastic scrap, our machines have the following advantages:

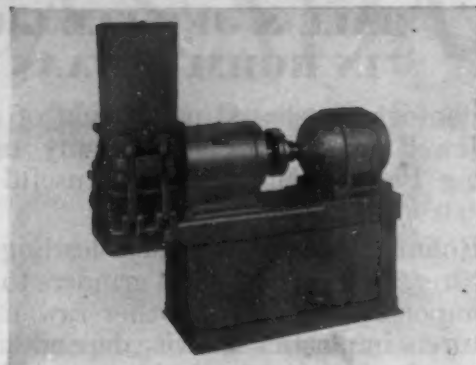
1. Extremely rugged construction.
2. Quick to dismantle.
3. Super-easy to clean for color changes.
4. Stall-proof cutting chamber runs full, cuts more.
5. Two models have added side feed slot to take continuously extruded strips.

Our four models span all normal requirements. # 1½, Machine Illustrated

Prompt deliveries. Request "Grinder Data."

CUMBERLAND ENGINEERING CO.

Dept. A, Box 216, Providence, R. I.



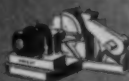
COTTON FABRICS

FOR REINFORCING
PLASTICS

★
J. H. LANE & CO., Inc.

250 W. 57th St New York, N. Y.

Materials PROCESSING EQUIPMENT



Sifters, Crushers, Cutters, Dry and Liquid Mixers,
Mills, Grinders, Pulverizers, Conveyor Systems,
Complete Installations.

The handling equipment construction "know-how" of the Mercer Engineering Works, Inc., Clifton, N. J. . . . The more than 46 years processing equipment experience of Robinson Mfg. Co., Muncy, Pa. . . . All are embodied in and represented by

MERCER-ROBINSON, CO., INC.
30 CHURCH ST., NEW YORK 7, N. Y.

Materials HANDLING EQUIPMENT



Trailer Trucks (All Types) Wheel Tractor Cranes
(3 to 7 ton) Fork Lift Trucks, Lift Platforms, Hoists,
Live Skids, Wheels, Casters.

Plastic Marking

IN GOLD, SILVER OR COLORS

Small Designs, Trade Marks, Names, etc.

Clean-cut precision markings on plastic parts at production speeds up to 1,000 per hour, using unskilled operators. Send samples and details of your stamping problems.



Kingsley GOLD STAMPING MACHINE CO.

★ HOLLYWOOD, CALIFORNIA ★

"C.A."

"C.A." Grade pearl essence, specially developed for use with Cellulose Acetate moulding powder.

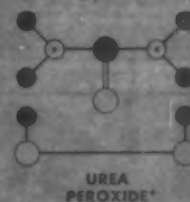
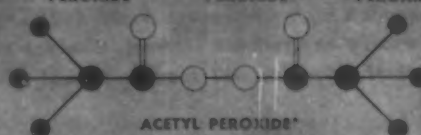
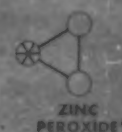
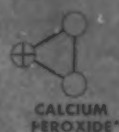
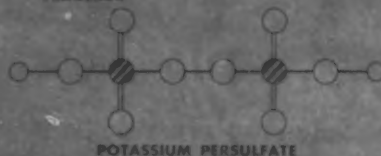
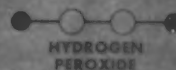
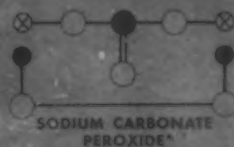
NON - YELLOWING



THE
MEARL
CORPORATION

153 Waverly Place New York, N.Y.

ACTIVE OXYGEN IS ON ACTIVE DUTY



BECCO Peroxides and Percompounds, both organic and inorganic, have been used throughout industry for many years. Most of our products have gone to war. Some of them are, at present, available in limited quantities while others are obtainable in research samples only. We welcome inquiries in connection with any of them and will be glad to answer your questions as to uses, availability and deliveries.

*Available in research quantities only at present.

**Will be available after the war.

BUFFALO ELECTRO-CHEMICAL COMPANY, INC.



BECCO
SALES CORPORATION
SALES AGENTS BUFFALO 7, N. Y.

thermoplastics scrap BOUGHT

reconditioned molding powder SOLD

SELL US YOUR THERMOPLASTIC WASTE. Sell us rejected molded pieces or obsolete molding powders—cellulose acetate, cellulose aceto-butyrate, polystyrene, methyl methacrylate, or polyvinyl resin.

WE SEPARATE ALL CONTAMINATIONS, removing steel or other mixtures—metal or anything else—and rework and plasticize the material into first class, ready-to-use reprocessed molding powder.

BUY FROM US when reconditioned molding powder is needed for your process. You'll find our product a trustworthy and reliable element. Contact us at our modern plant. Inquiries will receive prompt attention.

A. BAMBERGER
plastic
materials

Call or Write

Department M.

44 Hewes St., Brooklyn 11, N. Y.

Evergreen 7-3887

Cable: Chemprod

IT'S EASY

if you have an
ATLAS Type "E"

High Pressure Reducing Valve

Reduction of pressures as high as 6000 lb. per sq. in. "looks difficult" to many plastics plant executives. Such jobs are difficult with ordinary equipment, but not with ATLAS Type "E." This remarkable valve, shown at the left, handles such pressures with ease—without shock—oil, water, or air—and many users are so well pleased they "tell others" about their "find."

IS IT A SECRET PROCESS?

No, there is nothing secret about Type "E." It is, above all, modern in every detail. The body, for example, is of forged steel. The internal metal parts are entirely of stainless steel. A formed packing of special material superior to leather is used which is immune to all fluids commonly used in hydraulic machinery. The pressure on the seat is balanced by a piston with the result that variations in high initial pressure have little effect on the reduced pressure.

Ask for complete information.

For other ATLAS plastics plant products see the partial list in our ad in the January 1945 issue of MODERN PLASTICS

ATLAS VALVE COMPANY

REGULATING VALVES FOR EVERY SERVICE

277 South Street, Newark 5, N. J.
Representatives in principal cities

**CORRECT
ANSWER
TO MANY
PLASTIC PROBLEMS**

HOBBED CAVITY MOLDING

We've solved a lot of plastic molding problems based on our 25 years of experience with Hobbed Cavity Molding. Perhaps we can help you on some of your present or post-war problems.

**NEWARK DIE
COMPANY**

20-24 SCOTT ST. NEWARK, N. J.



EXTRUDED PLASTIC TAPE

**FOR CONTINUOUS
PUNCH PRESS
FEEDING**

Acetate Acetate Butyrate
Vinyls Ethyl Cellulose
Styrenes Styraloy

For any type of punch press operation, NATIONAL can supply continuous strip stock, made to accurate dimensions, suitable for washers, gaskets and shapes of any kind, or for such purposes as forming, blowing, beading and general fabrication. Furnished in thicknesses up to 1/8-inch and widths up to 6 inches.

NATIONAL PLASTIC PRODUCTS
Company
ODONTON, MARYLAND

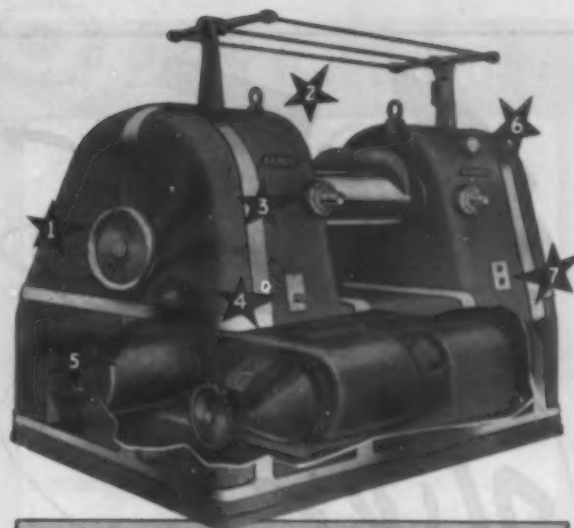
HOW MISKELLA INFRA-RED OVENS AND APPLIANCES SERVE THE PLASTIC INDUSTRY

Branch of the Industry	Name of Appliance	Use
Molders (Thermo-setting) Compression	PELLET-VEYOR (Variable heat)	To preheat pellets and preforms at the press as needed
Molders (Thermo-plastic) Injection	VIBRA-VEYOR (Variable heat)	To preheat plastic powder automatically. To dry plastic powder automatically
Injection	HOPPER-HEATER (Variable heat)	To warm up heavy metal of hopper of molding machine
Molders (Thermo-plastic) Extrusion	STRIP-HEATER (Variable heat)	To preheat strip rolls of vinylite, etc., automatically as fed to worm
Material Manufacturers	Special production equipment including vibrators, conveyors, stainless steel belts and electronic devices	To process various kinds of plastic material in bulk
Fabricators (Miscellaneous)	BENCH-KIT In various sizes (Variable heat)	To soften sheets, rods, tubes and any shape for bending, forming, punching, etc. This includes Cellulose, Acetate, Methyl Methacrylate

(The time on most of the operations mentioned above averages five minutes)
We sell lamps and build completely engineered infra-red equipment and appliance installations.

Drying, Baking, Processing and Preheating Specialists
INFRA-RED ENGINEERS & DESIGNERS

MANUFACTURERS
Main Office and Laboratory
1637 East Fortieth Street, Cleveland, Ohio



FEATURES OF THE EEMCO LABORATORY MILL

- 1 SPEED CONTROL**—gives operator any desired roll speed between 38 and 75 surface feet per minute.
- 2 SAFETY SWITCH**—disconnects motor from power line and immediately sets magnetic brake.
- 3 ADJUSTING SCREWS**—with calibrated dial enable operator to make accurate alignment of rolls.
- 4 TEMPERATURE REGULATION**—heating and cooling of rolls controlled by this accessible valve.
- 5 VARI-SPEED** motodrive and gear reducer—all in one compact unit.
- 6 TACHOMETER**—optional, shows surface speed of front roll.
- 7 PUSH BUTTON CONTROL**—for starting and stopping the variable speed motor drive.

Send for bulletins describing any of the following:

MILLS—HYDRAULIC PRESSES—EXTRUDERS—STRAINERS
WASHERS—REFINERS—CALENDERS—TUBERS—CRACKERS

EEMCO

ERIE ENGINE & MFG. Co.

953 EAST 12th ST., ERIE, PENNA.

Save Time -

**CUT COSTS
AND
SPEED PRODUCTION**

Use -



MILFORD *Semi-Tubular* RIVETS

If you are using solid rivets, or some other method of fastening, it might pay you to consult us—at least it doesn't cost anything to find out. Why not drop us a line today?



**MILFORD
RIVET & MACHINE CO.**

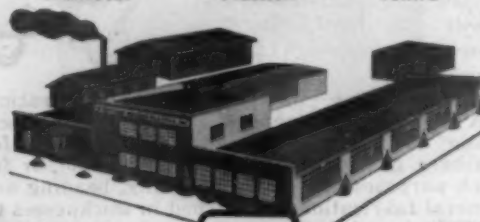
EASTERN DIVISION ★ CENTRAL DIVISION
MILFORD, CONN. ★ ELYRIA, OHIO

Experience Is the Answer to Plastic Problems

The molded plastic business cannot be learned over night as some people seem to believe. In fact, the knowledge of properly molding each of the many different plastic materials requires years of actual experience. Each characteristic requires special handling learned from scientific research and actual production.

Because our organization is built around men of long experience we are able to obtain the finest results from any of the following materials:

Bakelite	Lumarith	Resinox
Durez	Lucite	Saran
Ethocel	Plaskon	Tenite



**CUSTOM
MOLDING**



**EXTRUSION
INJECTION
COMPRESSION**

MICHIGAN MOLDED PLASTICS, Inc.
Dexter, Michigan

EXTRUDED THERMO PLASTICS



Made to Order ONLY
No Stock Items
Details, Quotations — Promptly

Ameroid

Casein Plastics

IN RODS, DISCS, SHEETS AND PUNCHED
FLAT SHAPES for fabricators. Non-in-
flammable, readily turned and machined.
Wide color range.

AMERICAN PLASTICS CORP.
225 West 34th St. New York City 1



NOW IS THE TIME

to start post war planning and working on plastic molded parts. Our engineers will be glad to call and discuss any problem having to do with compression or transfer molded parts.

RADIO CABINETS all sizes and other large housings are our specialty.

All our molds are made by men with more than thirty years experience. Our engineers offer a similar background of experience. Combined, they guarantee production of highest quality, good looking moldings on the highest possible production basis.

CONSULTATION with our engineers
is yours for the asking.

P **Plastimold, INC.**
ATTLEBORO, MASS.



PHENOPREG

Decorative Grades FOR POST-WAR PLANNING

We have available a limited number of decorative laminating materials which merit consideration in your postwar plans. Additional grades will be added to the Phenopreg list as rapidly as materials are available.

We invite your inquiries on the following materials for experimental work in connection with your post-war products.

PHENOPREG No. 279—A black surface sheet for low pressure lamination (250 psi) having good gloss qualities, excellent abrasion resistance, as well as water and solvent resistance.

PHENOPREG No. 290—A tan linen pattern printed on an opaque white paper impregnated with melamine resin.

PHENOPREG No. 292—A thin translucent surface sheet of high resin content for use as an overlay sheet on MB-290 grade to impart additional abrasion and solvent resistance. Can be laminated to other core materials when special surface properties are required. Melamine resin impregnated.

A limited number of colored melamine resin impregnated materials are available for test purposes.

Phenopreg materials laminate under the application of heat and pressure.

FABRICON PRODUCTS, INC.

(Formerly Detroit Wax Paper Company)

PLASTICS DIVISION

1721 Pleasant Avenue River Rouge 18, Michigan
Vinewood 1-8200

Saving MAN HOURS in thousands of FOREDOM FLEXIBLE SHAFT MACHINES American plants



Excellent For Use
On Irregularly
Shaped Parts



Touching Up
Production
Setups With-
out Dis-
assembly



In Tool, Die, Mold
and Patterns
Depts.

Finger-tip control . . .
plus a wide variety of ac-
cessories . . . means pre-
cision workmanship, un-
limited adaptability.

Here's versatility plus in any man's language. Let Foredom solve your production problems too. Pencil-size handpieces for the hard-to-reach places. Larger, ball-bearing handpieces for the heavier jobs, all quickly interchangeable. Flexible shafts which really ARE FLEXIBLE.

3 WAYS Right!

1. For de-burring, grinding, finishing, polishing and other light production jobs—particularly valuable on irregularly shaped parts.
2. In tool and die departments, for grinding, finishing and touching up dies, molds, jigs, etc.
3. For maintenance and emergency needs—touching up set-ups without disassembly, removing high spots on gears, identification marking of equipment, etc.

THOUSANDS OF PLANTS USE FOREDOMS, including Ford, General Motors, Chrysler, Nash-Kelvinator, Jack & Heintz, Sperry Gyroscope, Bendix, Westinghouse, etc.

Send coupon for a copy of our new Catalog No. 76, showing the complete line of Foredom Flexible Shaft Machines and Accessories.



Model illustrated is Foredom No. 340. Comes with either foot or hand-operated rheostat at \$45.70. (Available with suspension-type motor. No. 240, at \$43.20, including foot rheostat.) Other models as low as \$23.50.

Foredom Electric Company

27 Park Place, New York 7, N. Y.

Please send me your new Catalog No. 76, showing the different uses of Foredom Flexible Shaft Machines.

Name

Address

City Zone State

FOREDOM ELECTRIC COMPANY
27 PARK PLACE NEW YORK 7, N. Y.



INVESTIGATE NEW SURFACE DECORATION FOR PLASTICS!

Supplants old methods!

Permanent, Integral! Already in use by hundreds of firms in plastics field. Creative Printmakers new surface decoration process applies all colors to all plastics. Shape and size of molded or fabricated object is no limitation. All decorations applied permanently, bonded chemically with the piece. Used on lipsticks, packages, closures, dials, name plates, advertising premiums and many other items. Guaranteed not to scratch, wash or rub off. Weather resistant. Write for prices and information.

Creative

PRINTMAKERS GROUP

14 WEST 17th STREET • NEW YORK, N.Y. • Chelsea 3-6803

Surface Decorators for the Plastics Industry

ONE BENCH MACHINE FOR BOTH HORIZONTAL and VERTICAL Milling



Benchmaster mill with horizontal spindle and overarm

FOR PRECISION TOOL WORK OR HIGH-SPEED PRODUCTION

Benchmaster — offers a bench milling machine easily convertible from a conventional horizontal to a vertical miller by simply interchanging the spindle attachments.

ACCURATE • VERSATILE • LOW PRICED

SPECIFICATIONS: Table size — 6" x 14" — Three Tee slots 1/4", 2" center • Longitudinal travel 8 1/2" • Traverse travel 5 1/2" • Vertical travel 8 1/2" on vertical mill — 9 1/2" horizontal mill • Height 28" • Weight (less motor) 215 lbs. • Requires 1/2 h.p. motor • Spindle speeds (standard 1725 rpm motor) 430-850-1400-2100 rpm.



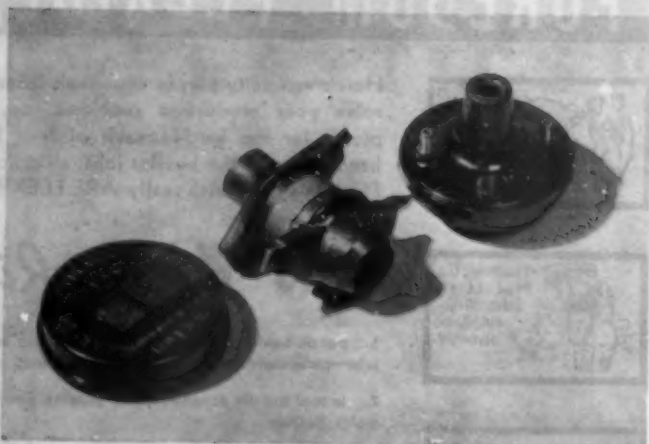
Benchmaster manufacturing company

2952 W. PICO, LOS ANGELES 6, CAL.

SKILLED AND TOOLED FOR PRECISION MOLDING



Automotive Parts...



Custom Molded Plastics engineered by Midwest, consistently measure up to exacting specifications and requirements. Address your inquiries to MMM, confident that you are consulting an organization skilled and experienced in precision techniques for the production of plastics.

Midwest Molding
AND MANUFACTURING COMPANY

331 NORTH WHIPPLE STREET • CHICAGO 12



For PLASTIC PEARL PATTERNS

Use G-P Aqueous Crystal Paste Miscible in all plastics in which water is compatible, such as Casein, Phenol Formaldehyde, etc.

We invite requests for free samples.

Fine Chemical Division

IVANO INCORPORATED

166-184 Commercial St. Malden 48, Mass.

NUMBERALL ROTARY STAMP

Patented

A handy, single wheel Stamp for stamping figures and letters on brass, aluminum or soft steel, and also plastic and wood, with but a single hammer blow. More efficient than individual hand stamps because all figures are on one wheel, and entire alphabet on two wheels. Change of characters are quickly made by rotating the type wheel. Wheels are renewable. One stamp does away with 12 individual hand stamps. Wheel is made of tool steel and characters engraved for maximum stamping service. Characters furnished any size from $\frac{1}{16}$ " up to $\frac{3}{8}$ ". Also can be supplied with shank for press. Write for Bulletin MP-1H.



We also make numbering machines, automatic or non-automatic, for stamping numbers and letters into metal.

NUMBERALL STAMP & TOOL CO.
HUGUENOT PARK STATEN ISLAND 12, N. Y.



**You Can Finish Plastics
FASTER with PERFECT
SAFETY—by using the
3-M METHOD**

• Even when a large amount of stock must be removed, plastics can be finished at high speed, by the 3-M Method, without plastic flow, burning or discoloration. On either flat or curved surfaces this cool grinding method gives increased production and lower production costs. Eliminated, too, is the "loading" or "filling" of the abrasive; you get two to five times more service from each abrasive belt. Tolerances as close as .005 inch can be maintained without sacrificing speed. Add to these features the fact that the 3-M Method gives you finer finishes, requiring a minimum of final polishing, and you have ample reason for trying this method in your plant. Ask your distributor of 3-M Products about this cost-cutting finishing method, or mail the coupon below for our booklet.



Please send us a copy of your booklet, "Faster, Better Finishing of Metal, Plastic and Glass." MPL945

Name _____
Company _____
Address _____
City _____ Zone _____ State _____



Small Headaches of Today

FACILITIES:

DESIGN AND MOLD SHOP
PRINTING DEPARTMENT
FINISHING DEPARTMENT

INJECTION MOLDERS OF:

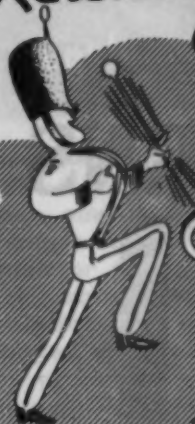
TENITE I LUCITE
TENITE II POLYSTYRENE
VINYLITE LUMARITH
PLEXIGLAS



**MINNESOTA
PLASTICS
CORP.**

366 WACOUTA ST.
ST. PAUL 1, MINNESOTA

Leading the field!



**INJECTION
AND
COMPRESSION
MOLDINGS**



Recto

MOLDED PRODUCTS INC.

CINCINNATI 9, OHIO

MELROSE 6862

DETROIT

L. S. HOUSE

3-167 GENERAL MOTORS BLDG. MADISON 5781

*Oakite
Answers to
Plastic
Production
Problems!*

**Surface
Preparation of
Plastics**

Oil, grease, buffing compounds and paste, shop soil and various other deposits . . . all these can be removed safely from whatever type of plastic parts you are using with Oakite cleaning materials designed for this work.

Oakite Technical Service Representatives have a wide knowledge of the cleaning problems associated with plastics and can recommend the material and method that will safely, easily and economically clean surfaces and prepare them for subsequent finishing, plating or final assembly.

Various Oakite materials are also available for use as coolants in sawing, drilling, threading and tapping operations on plastics. Tell us your problem. Our experience and personal help are yours for the asking without cost or obligation. Write us today.

OAKITE PRODUCTS, INC., 46D Thunes St., NEW YORK 6, N. Y.
Technical Service Representatives in All Principal Cities of the United States and Canada

OAKITE



CLEANING



**ACTIVE IN THE
PLASTIC FIELD
for 22 YEARS**

BOUGHT — SOLD or RECLAIMED for You!

A complete converting service!
It will pay you to investigate our
facilities for reworking your scrap.

**CELLULOSE ACETATE — CELLULOSE BUTYRATE
STYRENE VINYL AND ACRYLIC RESINS**



A Dependable Source of Supply for re-worked Cellulose Acetate
and Cellulose Butyrate molding powders

GERING PRODUCTS INC.

North Seventh St. & Monroe Ave., KENILWORTH, N. J.

Chicago Office: 622 W. Monroe St.

COLORFUL
DURABLE
DEPENDABLE
SALEABLE

**Fabricated
PLASTIC
FILMS**
VINYL • BUTYRAL
CELLULOSE ACETATE
for
Wearing Apparel, Sporting
Goods and Household
Items

**Laminated
PLASTICS**
OF ALL TYPES
VINYL
BUTYRAL
CELLULOSE ACETATE

**Fabricated
BOXES
CANNISTERS**
in all forms and
shapes for packaging
purposes

NATIONAL TRANSPARENT PLASTICS CO.
SPRINGFIELD, MASS. • NEW YORK OFFICE: 507 FIFTH AVENUE

**SERVING
TRADE and
OTHER IN-
DUSTRIES**
COSMETIC, DRUG

GLYCERINE ...quickly available

Armour's 332 stock points mean
fast, dependable service

U. S. P. . . . A chemically-pure,
water-white glycerine, meeting
all requirements of the U. S.
Pharmacopoeia . . . for use in
foods, pharmaceuticals, cosmet-
ics or any purpose demanding
highest quality. Specific grav-
ity, 1.249—25° C./25° C.

HIGH GRAVITY...A pale yellow
industrial glycerine. Specific
gravity, 1.262—15.5° C./15.5° C.

DYNAMITE . . . Made especially
for the explosives trade. Specific
gravity, 1.262—15.5° C./15.5° C.



**ARMOUR
AND
COMPANY**

1355 W. 31st St., Chicago 9, Illinois

DON'T FORGET — WE ARE CUSTOM MOLDERS TOO

It is true that we are specialists in molding insulation. It is also true that we have developed a number of stock mold items with special emphasis on insulation such as our Safety Strain insulators, terminal blocks, X-ray tube shields and high tension insulators. But we are, to a very large extent, custom molders. A lot of our customers draw on our extensive knowledge of plastics as insulating materials built up over our more than 50 years of molding insulation. We have never neglected any phase of plastics molding. We turn out a wide variety of molded parts, custom made to the specific requirements of a wide number of industries. We would be glad to help you with your custom molding problem.



INSULATION MANUFACTURING CO.

CUSTOM MOLDERS OF PLASTICS FOR INDUSTRY

11 New York Avenue

Brooklyn 16, N. Y.

御氣の毒ごまかせ
其の
家談計
は必要ありません



*SO SORRY... NO NEED PYROMETER

To guess the temperatures of mold cavities is to sabotage critical powders. Wrong molding temperature is the principal cause of off colors, soft centers and out-of-shape pieces. Every plastic molder needs a dependable pyrometer. The Cambridge Mold Pyrometer

is an accurate, sturdy, quick-acting convenient-to-use instrument. Its routine use will go a long way in reducing spoilage.

**BUY
WAR
BONDS**

Cambridge Instrument Co., Inc.
3711 Grand Central Terminal, New York 17, N. Y.

CAMBRIDGE

Mold * Surface * Needle

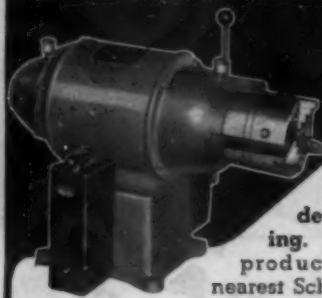
PYROMETERS

Combination and single
purpose instruments

Bulletin 194-S gives details of these instruments. They help save money and make better plastics.

IDEAL SPEED LATHES

For accurate, uniform,
speedy finishing of
metal & plastic parts.



a type and size for
every secondary finish-
ing operation—polishing,
de-burring, lapping, grind-
ing. For lower-cost peacetime
production, write or call your
nearest Schauer representative:

Colcord-Wright Mch. & Supply Co.
1223 N. Broadway, St. Louis 6

Eichman Machinery Company
235 W. 8th St., Kansas City 6

The E. L. Easley Machinery Co.
Chicago 22 Milwaukee 3
Grand Rapids

Federal Sales & Engineering Co.
Transportation Bldg., Washington 6

Goodspeed-Detroit Company
2832 E. Grand Blvd., Detroit 11

The C. H. Gosiger Mch. Co.
Dayton 2, Ohio

Harron, Rickard & McCone Co.
Los Angeles 11 San Francisco 10

The E. A. Kinsey Company
311 W. 4th, Cincinnati 2

Marshall-Huschart Mch. Co.
C of C Bldg., Indianapolis 4

Motch & Merryweather Machy. Co.
Cincinnati 2 Cleveland 13
Pittsburgh 22

The Satterlee Company
118 Washington Ave., N., Minn. 1

W. E. Shipley Machinery Company
1421 Chestnut St., Philadelphia 2

Syracuse Supply Company
Syracuse, Buffalo, Rochester

Triplex Machine Tool Corporation
125 Barclay St., New York 7

W. W. Wentz
121 Powers Hotel, Rochester, N. Y.

Williams & Wilson, Ltd., Canada
Toronto, Montreal, Windsor, Quebec



**SCHAUER MACHINE
COMPANY**

ORIGINATORS OF TODAY'S SPEED LATHES
2045 READING ROAD CINCINNATI 2, OHIO

COLOR *your* PLASTICS

by
Dipping
Them COLD

"REZ-N-DYE"

TRADE PLASTIC DYES MARK

Have been used in the coloring of plastics for over three years. They are time proven. Will color Lucite, Plexiglas, Cellulose Acetate, Cellulose Nitrate, Butyrate, Ethyl Cellulose, Casein, Reclaimed Film, Synthetic Rubbers, Vinylite, Latex, etc., by merely dipping—instantaneously for light shades; 3 to 5 minutes for deep shades; followed by a rinse in water. No heating—No diluting.

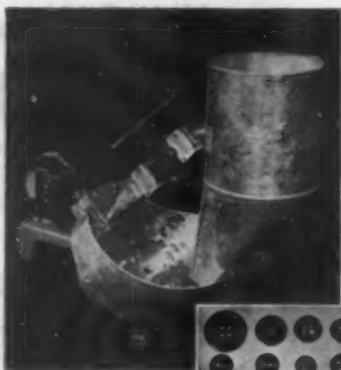
SCHWARTZ CHEMICAL CO.

326 West 70th St.

New York 23, N. Y.

Automatic Button Finisher-

**ELIMINATES
MANPOWER
PROBLEMS**



THIS compact automatic machine punches fins and cleans holes of Urea, Phenol and Melamine buttons. Completely automatic it saves countless man-hours of work and performs with perfect efficiency. Can be set & re-set to handle all sizes. 3 models: Model S accepts sizes 12 to 34; Model SP accepts sizes 36 to 50; Model SX accepts sizes 12 to 50. Production up to 450 per minute.



ButtOndeX

CORPORATION

386 FOURTH AVENUE

NEW YORK, N. Y.

New LIFE

IN OLD PRODUCTS

with
**PLASTIC
MOLDED
PARTS**

MANUFACTURERS who are confronted with production problems may do well to consider Franklin and custom molded plastic parts. Specializing in injection molding Franklin has both the personnel and modern production machinery so necessary to produce plastic parts, in quantity, for manufacturers. Your inquiry will receive careful attention.



Buy
WAR BONDS
AND STAMPS

★ ★ ★

Franklin

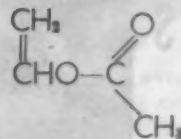
FRANKLIN PLASTICS DIVISION

Robinson Industries, Inc. - - FRANKLIN, PA.

Metaplast

238

(STABILIZED)



Purity 99.5% Boiling Range 71.8° to 73°C.

Vinyl Acetate can be polymerized to form resins with exceptional bonding qualities for wood, glass, metal and fibre

Containers:—

410 lb. drums; 62,500 lb. tank cars

For further information write to:

NIACET

CHEMICALS DIVISION

UNITED STATES VANADIUM CORPORATION

Sales Offices

915 Niagara Building • Niagara Falls, N. Y.

MOLDS

INJECTION

Submit your problems to our experienced engineering staff, equipped to handle your most intricate mold problems.

We design and build automatic molds for many leading molders. Why not let us solve your problems? Our molds are tested before shipping, on our new 16 oz. Lester injection molding machine. 1911 • 1945

STANDARD TOOL CO.

75 WATER STREET

LEOMINSTER, MASS.

N. E. Sales representatives for—
Lester Injection Molding Machines
Ball & Jewell Grinders

Remove Moisture from PLASTICS



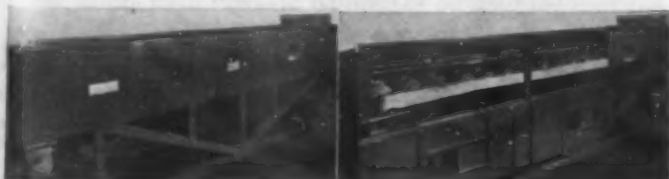
Quickly and Cheaply with
NALCO Infra-Red LAMPS

Do you know . . . all of the advantages of Infra-Red Ray Drying with Nalco Dritherm Carbon Filament Lamps?

Use Nalco Ditherm Lamps for efficient results . . . available in Inside-Silvered (self-reflecting) or clear glass types.

Learn all of the advantages of the Infra-Red process for plastic dehydration.

Write for your free copy of "Drying Problems Made Easy" today.



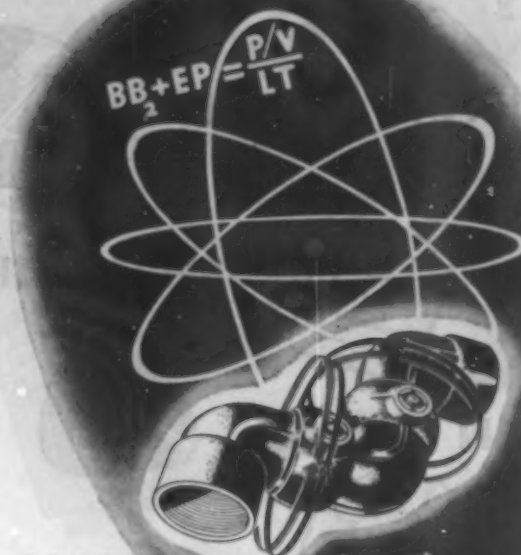
Exterior of Infra-Red Conveyor Belt Tunnel for removing moisture from plastic material prior to molding.

Sides dropped to show arrangement of Infra-Red light bank and materials passing under light conveyor belt.

North American Electric Lamp Co.

1012 Tyler Street

St. Louis 6, Missouri



AROUND . . . and AROUND
and back . . . and forth

BB₂ = Double Rows of Ball Bearings
EP = Effective Packing Element
P/V = Pressure or Vacuum
LT = Low Torque under all conditions

Perfect flexibility with low torque is assured in every CHIKSAN Ball-Bearing Swivel. Yet Chiksan design and construction are so sound they can be expressed in a simple formula. There is nothing to tighten or adjust . . . no stuffing boxes to put the brakes on easy turning and thus produce excessive strains on pipe lines and fittings. Smooth, easy turning throughout 360° is provided in one, two and three planes. Packing Element is so effective the same Swivel may be used for either pressure or vacuum service . . . for loading or unloading. Chiksan Ball-Bearing Swivels are built for pressures to 3,000 p.s.i. and varying temperatures. Write for latest catalog.



**CHIKSAN REPRESENTATIVES
IN PRINCIPAL CITIES**

Distributed Nationally by Crane Co.



CHIKSAN COMPANY
BREA, CALIFORNIA

CUSTOM MOLDING

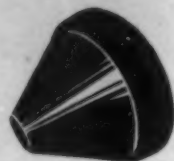


TO



SPECIFICATION

CAN ASSURE



THE



SUCCESS OR

FAILURE



OF YOUR

PRODUCTION



"Call on Connecticut"

Our design and production facilities, still working night and day on vital war necessities, should soon again be available for peace time requirements . . . then we will again be able to individualize the beauty or improve the quality of your products through our custom molding.

Custom **CONNECTICUT** **Plastics** **Molders**

CONNECTICUT PLASTIC PRODUCTS CO.

70 WEST LIBERTY STREET — WATERBURY, CONNECTICUT

LET US TELL YOU HOW YOU MAY USE OUR ORGANIZATION JUST AS IF IT WERE YOURS
YOUR INQUIRY WILL BRING THE ANSWER
(3 Minutes Reading Time)



Waterbury
MOLDINGS OF MERIT

**COMPRESSION
TRANSFER
INJECTION**

WATERBURY COMPANIES, INC.
Formerly Waterbury Button Co., Est. 1812
Dept. B, WATERBURY, CONNECTICUT



Racine Plant

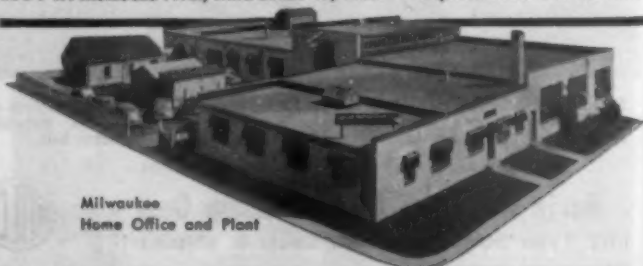
2 Modern Plants

GEARED TO PRODUCE MOLDED PLASTIC PARTS BY THE HUNDREDS OR MILLIONS

● We are equipped to render you a complete service—from engineering to final inspection. Our specialty—precision compression and transfer molding of thermo-setting plastics. Expert attention to your inquiry—no matter how little or big—how simple or complex the requirement.

TAYLOR **HI-EFF** **MANUFACTURING Co.**

3084 W. Meinecke Ave., Milwaukee 10, Wis. • Representatives in 20 Cities



Milwaukee
Home Office and Plant

PLASTICS

NEW DESIGNS?
NEW PATTERNS?
NEW MODELS?

Speed experimental work and fabricating with the **STANLEY-CARTER Combination ROUTER-SHAPER**

For Routing, Shaping, Paneling, Drilling, Beading, Inlaying, and many other fabricating operations needed in preparing models or samples of plastic products, this truly "all 'round" machine will save you time and speed completion of neatly finished work.

Motor unit is 1 H. P., 18,000 R. P. M. When mounted in a motor holder below table, converts router to shaper. Motor holder may be tilted to any angle up to 45° either way. Furnished with or without table shown.

Complete details on request. Stanley Electric Tools. Stanley-Carter Sales Dept. 175 Elm St., New Britain, Conn.



CARTER STANLEY **TOOLS**

DO YOUR OPERATIONS INVOLVE

Joining Rigid Plastics

TO GLASS, METAL, WOOD, FABRIC,
LEATHER OR OTHER PLASTICS?

Our research and Technical Staff is experienced in developing specialized adhesives for special applications, including the plastic field. They may help you to bond these joints with Miracle Adhesives *without the need for screws, clips or mechanical fasteners—and without heat.*

We can serve you best when you send full details to Research Department, Miracle Adhesives Corporation, 852 Clinton Avenue, Newark 8, New Jersey.



**MIRACLE
ADHESIVES**



The Azimuth Indicator is a perfect example of a complete unit designed and produced by Felsenthal. The dial body and crystal are injection molded of Lucite. The calibrated dial shows forming and printing of Vinylite. Your plastic problems, too, become production realities at Felsenthal.

TO PRODUCT



IN Plastic BY
FELSENTHAL
MANUFACTURERS — SINCE 1899



G. FELSENTHAL & SONS

4120 W. GRAND AVE. • CHICAGO 51, ILLINOIS

Something Worth Learning—and Remembering!

"My entire business life in the field of molded plastics is your assurance of the correct solution of your particular molding problem"

M. W. Martindell

Remembering this statement may prove to be of great importance to you in your after-the-war production. Consultation with this organization could mean the difference between profit and loss to you. We can help you choose the right material, the right production method, and even the right design and construction of the mold.

MARTINDELL MOLDING CO.
OLDEN and 6th Street • TRENTON, NEW JERSEY



• ACRYLICS • CELLULOSE ACETATE • POLYSTYRENE • ETHYL CELLULOSE •

Dealers
in

**PLASTICS
SCRAP**

**MEYER & BROWN
CORP.**

Founded 1894

347 Madison Ave., New York 17, N. Y.

ETHYL CELLULOSE • CELLULOSE ACETATE • BUTYRATE • POLYSTYRENE • ETHYL CELLULOSE • VINYL RESINS

CELLULOSE ACETATE • ETHYL CELLULOSE • BUTYRATE • POLYSTYRENE • ETHYL CELLULOSE • VINYL RESINS

• ACRYLICS • CELLULOSE ACETATE • POLYSTYRENE • ETHYL CELLULOSE •

DO YOUR PLASTIC MODELING INVOLVE



Avoid costly errors in post war products. MODEL before you MOLD.

COMPRESSION • INJECTION • TRANSFER MOLDS

STRICKER BRUNHUBER CO.

Mechanical Developers

19 WEST 24th ST.

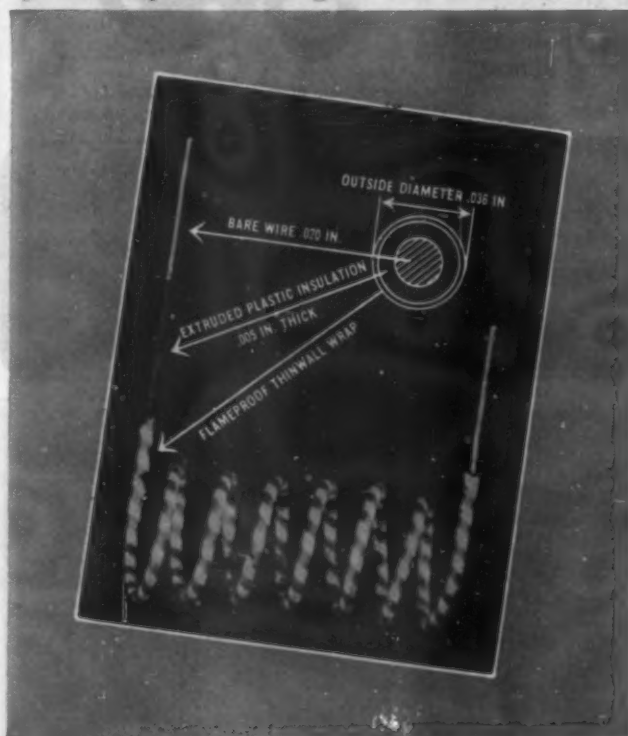


NEW YORK 10, N. Y.

THE WESTERN UNION TELEGRAPH CO.

installs SURCO THINWALL WRAP after Rigid Testing

... the first uniformly high quality
fine wire, plastic insulated with flame
proofed yarn serving.



This photo of typical construction is absolutely unretouched

Voltage Breakdown — 7000 Volts

(For spiraled section shown in photograph after 5 minutes in water)
Insulation Resistance—30 Megs. Per 1000 Ft. at 60°F. (After
72 hrs. in water)

Here are Thinwall's Characteristics:

High dielectric properties, Maximum saving in space and weight, Unlimited coding and identification, High temperature operation, Excellent abrasion resistance and toughness, Maximum protection against damage by soldering iron, Unusual flexibility at below freezing temperatures, Flame-proof qualities, Good end and spot-stripping characteristics, Low cost.

Surco-American Thinwall Wrap is available in a wide variety of formulations finer sizes of wire and thinner insulations than shown above, for use where maximum performance under specific operating conditions is required.

Surprenant
ELECTRICAL INSULATION CO.
Dept. T 84 Purchase St., Boston 10, Mass.

AUBURN MOLDS

Mean a Better Molding Job

When you choose Auburn as your custom molder, Auburn's engineers will construct a mold that will take full advantage of all the inherent characteristics of the plastics materials used . . . a mold that will mean uninterrupted, economical production of your plastics part.

This mold-making ability is the result of Auburn's 68 years molding experience . . . years in which Auburn's skill and reputation have grown steadily until, today, the Auburn mold mark is virtually a guarantee of a perfect molded part.

For small parts molded automatically at low cost, write: Woodruff Company Division, Auburn Button Works, Auburn, New York.

MOLD  MARK

AUBURN ENGINEERED PLASTICS

All Types of Molding Complete Mold Shop
Extruded Tubes and Shapes

AUBURN BUTTON WORKS

INCORPORATED

MOLDERS SINCE 1876 AUBURN, NEW YORK



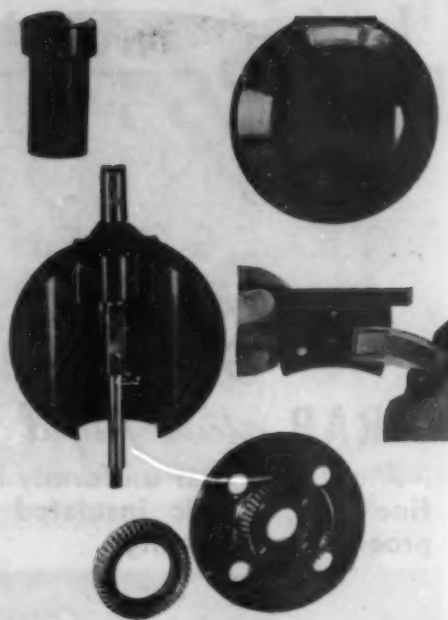
When you think of Plastics, think
of possibilities—and ask
NORTHERN.

MARK V

SURFACE LOOKOUT ALIDADE

Here again **PLASTICS** broke a bottleneck in the production of this device. Nine moulded plastic parts including bevel gears with the utilization of some metal parts such as the center shaft and perforated dial, etc., comprise the complete assembly. Close tolerances in moulding almost entirely eliminate machining. Several types of plastic are used — each best fitted to the purpose.

Severe impact tests proved the soundness of the design. Plastic construction greatly increased production and also at the same time cut manufacturing costs almost in half.



Approximate diameter of Main Housing - 9"
Total weight of moulded parts - 6 lbs.

Northern Industrial Chemical Company

7-11 ELKINS ST., SO. BOSTON 27, MASS.

35 YEARS OF PLASTIC MOLDING EXPERIENCE

SPECIALISTS

INJECTION MOLDING

THE GROTELITE CO.

INCORPORATED
GRANDVIEW & LAFAYETTE AVE.
BELLEVUE, KENTUCKY

"PIONEERS IN PLASTICS"

ESTABLISHED 1922

**Complete Plastic
Fabricating Facilities
FOR
INDUSTRIAL USE**

OIL CUPS, LENSES, MACHINE GUARDS, WASHERS, RINGS, GASKETS, ETC. FABRICATED FROM LUCITE, PLEXIGLAS, VINYL AND OTHER PLASTICS... ARE ECONOMICAL — PERFORM WITH GREATER EFFICIENCY. When practical the extreme flexibility of the different plastics offer many qualities which prove extremely advantageous for industrial use. Our complete facilities and skilled engineers are now available for war work and post-war work. Show us samples or blueprints — we'll tell you if your product should be made from plastics. Wire or write today, attention Department MP.



TRANSPARENT

Specialties Corp.
1120 CARNegie AVE.
CLEVELAND 15, OHIO

HAPPY COMBINATION

- Accuracy
- Cost-Consciousness

Above all else, we insist that every one of the tens of millions of plastic molded pieces produced in our modern plant be a masterpiece of accuracy. This desire is a passion . . . a fetish with us.

Yes, we insist upon accuracy. But we don't lose sight of the cost factor, either. Because the time will come—soon—when we shall enter a highly competitive phase of manufacturing. We know how to keep costs down—without sacrifice of quality. That ability will mean much in the postwar era.



IDEAL PLASTICS CORPORATION

A DIVISION OF IDEAL NOVELTY & TOY CO., INC.
23-10 43rd AVE., LONG ISLAND CITY, N. Y.

PLASTICS

MOULDED TO YOUR JOB

EACH item made in plastics sends forth its own bid for Sales Appeal, Durability and the savings of light weight.

But it's knowing how to use plastics that spells the difference. That's why your work at Magnetic Plastics is custom moulded from the plastics that best withstand the wear their job demands.

Ask us to help you see what plastics can do in your business. Just send photo, sample or specifications, and we'll tell you quickly if it can be made in moulded plastics.



THE MAGNETIC PLASTICS CO.

1900 EUCLID BLDG. • CLEVELAND 15, OHIO

CONTRACT

PLASTICS MOLDING

INJECTION AND COMPRESSION MOLDING IN ALL
THERMOPLASTIC AND THERMOSETTING MATERIALS

EXAMPLE OF
WIDE SIZE
RANGE



We have the set-up and experience to give you the best in plastics molding of small and large parts, in small or large quantities, at reasonable prices.

QUOTATIONS
on specific
requirements
without
obligation

S.S. WHITE PLASTICS

THE S. S. WHITE DENTAL MFG. CO. DIVISION



DEPT. M, 10 EAST 40TH ST., NEW YORK 16, N. Y.
FLEXIBLE SHAFTS AIRCRAFT ACCESSORIES
MOLDED PLASTICS
MOLDED RESISTORS FLEXIBLE SHAFT TOOLS

In New Product Design

INDUSTRIAL'S
technical Skill
can help you...

We can be of service to you in product development. Our staff of highly skilled experts in die-making ... in custom molding, can help solve many plastic problems of design engineers. Why not consult with us? Just write

**INDUSTRIAL
MOLDED PRODUCTS CO.**

2035 W. Charleston Street

Chicago 47, Illinois

A fast, practical, scientific
**PRE-TEST FOR
WEAR RESISTANCE**

The TABER ABRASER
gives "Advance Data"
on the Wearability of
**PAINTS · LACQUER · PLATING
LEATHER · RUBBER · PAPER, ETC.**



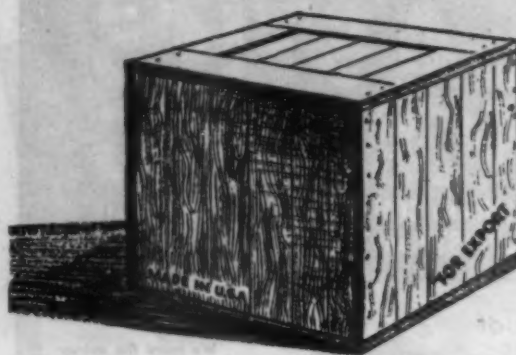
In checking the wearability of your own products as compared with competitors', as well as in research on new developments—the Taber Abraser gives you an accurate rating of resistance to surface abrasion quickly, simply. Eliminates slow, costly performance tests. Used by hundreds of manufacturers and research laboratories. . . . Full particulars on the Taber wear testing procedure will be sent on request. No obligation.

TABER INSTRUMENT CORPORATION

111 MC Goundry Street

North Tonawanda, N. Y.

The Taber Test Proves What Wears Best!



FOREIGN FREIGHT CONTRACTORS



OUR SERVICE
IS BACKED BY
Over 38 Years'
EXPERIENCE



Wedemann & Godknecht, Inc.

EXPORT & IMPORT FORWARDING AGENTS

CUSTOM HOUSE BROKERS

100 BROAD STREET, NEW YORK 4

Telephone: Whitehall 4-7990-1-2-3

Teletypewriter No. NY 1-2694

Cable Address: WEDEMANN

for

Plastics

New 6 x 16

LABORATORY CALENDER

• • built to duplicate functions of large production units. The rolls are of the finest chilled iron, hollow chambered for heating or cooling, and may be operated at either friction or even motion ... with the NEW G. E. Thy-mo-trol Drive, an infinite speed range may be obtained. Write for specifications.

Wm. R.
Thropp & Sons Co.
Trenton, N. J.



7x MORE=PLENTY!

Workers in PLASTICS are discovering that Jomac Industrial Gloves give up to 7 times more wear than the ordinary work-glove! That's the economy record of Jomac Gloves in leading shops. Protecting workers' hands with their cushiony, loop-finished cloth ... saving man-hours and stepping-up production by reducing injuries. Jomac Gloves are washable, too ... can be laundered repeatedly! Also available in special Heat- and Flame-Resisting styles.



TRY JOMAC GLOVES—Test them in your own shop—on your *toughest jobs*. Check them for wear, for washability, for increased production. Write for full details. C. WALKER JONES CO., Philadelphia 38, Penna.

JOMAC'S LATEST CREATION—Safety GAUNTLET-CUFFS. Now, you simply replace worn glove without the expense of buying full gauntlet.

JOMAC

INDUSTRIAL GLOVES

Three Types of Jomac Gloves

- Regular Industrial Type
- Heat- and Flame-Resisting
- Safety Gauntlet-Cuffs

Heating Problem?

CARTRIDGE UNITS



STRIP UNITS



CYLINDRICAL UNITS



IMMERSION UNITS



GET WATLOW ELECTRIC HEATING UNITS ON THE JOB!

Whether it's a fraction of a square inch or square feet of heating surface—whether it's a cubic inch or cubic yards of heating volume—Watlow, with its 20 years of specialization, can provide the electric heating unit to provide the exact degree of accurately controlled heat needed.

Watlow stock units, or designed-to-specification units are constructed for long-life and trouble-free service.

Write NOW about your current heating problem or your postwar needs.

WATLOW

ELECTRIC MANUFACTURING COMPANY
1321 N. 23d St. St. Louis 6, Mo.

Send for Complete Catalog on Industrial Heating Units

SPECIALISTS IN ELECTRIC HEATING UNITS



PLASTICS MACHINERY

for cutting **cost** corners
in processing

The day will return when production costs will again be of equal importance with "how many" and "when." To get your costs in line you will need modern machinery—machinery that has been designed specifically for handling plastics. Because Farrel-Birmingham machines are *designed for the job* of processing plastics, they will give you favorable answers to the questions of cost, quality and output.

BANBURY MIXERS produce mixes of exceptional uniformity and superior quality, with large savings in power, labor and other costs. The heat necessary for handling plastics can be maintained at constant temperature. A wide variety of materials, colors or formulas can be processed without difficulty. Dust and fume hazards are eliminated. Positive, automatic control of entire procedure is provided.

ROLL MILLS are designed for high temperature converting and mixing, and are provided with attachments and equipment to suit individual requirements. Chamber-bored rolls, fitted with special type stuffing boxes, are carried in water-cooled, flood-lubricated journal boxes. High strength materials provide the necessary ruggedness for heavy duty service. The rolls can be chrome-plated and the adjustable guides and mill pan made of non-corroding metals where required.

CALENDERS for sheeting and coating plastics are available with any number and arrangement of rolls, and fitted with attachments to suit their particular function. The calender shown here has individual motors for each screw of the top, bottom and side rolls. This makes possible independent or synchronized adjustment of roll ends for close control of gauge. Rolls are chamber-bored for steam circulation. Many other features also contribute to efficient operation and product quality.

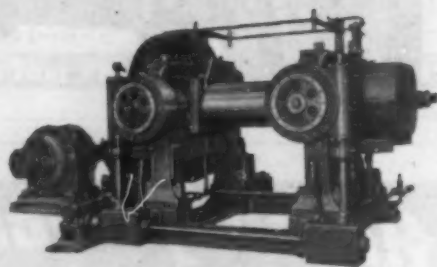
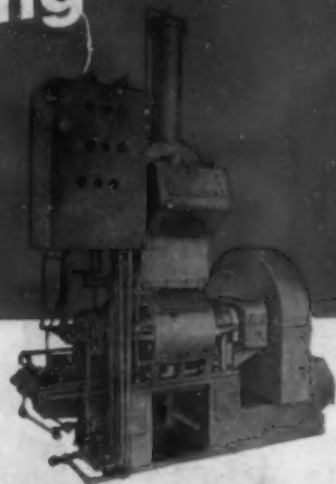
Write for further information about any of the machines shown or listed on this page.

FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONN.

Plants: Ansonia, Derby and Stonington, Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Pittsburgh, Akron,
Los Angeles, Tulsa, Houston, Charlotte

FB-240

Farrel-Birmingham



F-B PLASTICS MACHINERY

Banbury Internal Mixers Roll Mills
Converting, Mixing and Sheeting Rolls
Calenders Extruding Machines
Hydraulic Presses Hydraulic Accumulators
Sheet Cutters or Planers

All of p

FOR 5
3 GPM
2' ram
4-W.
Mill
Com
motor
cumu
form
12 x 14
Pulver
list.

WANT
any fo
styren
surplu
terials
Reply

IN TH
Nickel
chine
Box 82

FOR 8
down
\$12, M

Low
sub
sets
ind
Am
real
We
eat
ever
Bro

WANT
moldi
or inj
shop.
Mod

DRAF
desig
progr
New Y
maner
Give f
sired.

WANT
jects i
Styren
Submi
grades
Box 50

WANT
cuts u
quanti
plexig
Plastic
York 1

PLEXI
Interes
clean,
and ot
and un
quanti

Do y
pres
Lam
Hob
hydr

Spec
used

Argent
gating
public
Cellul
factory
The Co
Aires.

Sales
use
exch
Writ
P.O.

All classified advertising payable in advance of publication. Minimum, \$5.00 (up to 60 words); in border, \$10.00 per inch.

Classified Advertisements

For further information address Classified Advertising Dept. MODERN PLASTICS 122 East 42nd St., New York 17, N. Y.

FOR SALE—1 Worthington Hyd. Pump 1 x 6, 5 GPM 6000 pressure M.D. 1—14" x 24" Press, 9" ram; 4—24" x 55" steel cord Heating Plates; 4—W. & P. Mixers; 1—Thopp 10 x 24" Rubber Mill; 1—8 x 13" Rubber Mill; 1—set of 18 x 50" Compounding rolls, reduction gear and motor; 1—French Oil Hydropneumatic Accumulator; 1—Stokes Rotary 32 punch Preform Press; 6—Hydraulic Presses, 20 x 20", 12 x 14", Allen 6" Tubers; Dry Powder Mixers; Pulverizers, Grinders, etc. Send for complete list. Reply Box 1310, Modern Plastics.

WANTED: PLASTIC SCRAP OR REJECTS in any form. Cellulose Acetate, Butyrate, Polystyrene, Acrylic, Vinyl Resin, etc. Also wanted surplus lots of phenolic and urea molding materials. Custom grinding and magnetizing. Reply Box 318, Modern Plastics.

IN THE MARKET FOR: Stainless Steel or Nickel Kettles, Vacuum Pan, Preform Machine and Mixer, Hydraulic Presses. Reply Box 825, Modern Plastics.

FOR SALE: 1—500 ton Hydraulic Press with downward moving ram and pushbacks. Box 512, Modern Plastics.

Long established reputable concern with substantial capital will buy for cash, Assets, Capital Stock, Family Holdings of industrial plants, mfg. divisions, units. Among other considerations, you may realize certain desirable tax advantages. We are principals and act only in strictest confidence, retaining personnel wherever possible. Address Box 1230, 1474 Broadway, New York 18, N. Y.

WANTED: Small or medium sized plastic molding plant with either hydraulic extrusion or injection equipment with or without tool shop. Advise full details. Reply Box 788, Modern Plastics.

DRAFTSMEN-ENGINEER—Duties to include designing of die casting dies and fixtures for progressive manufacturing plant located in New York City, established over 25 years. Permanent post-war position. Excellent future. Give full details of experience and salary desired. Reply Box 1296, Modern Plastics.

WANTED: THERMOPLASTIC SCRAP or rejects in any form, including Acetate, Butyrate, Styrene, Acrylic and Vinyl Resin materials. Submit samples and details of quantities, grades and color for our quotations. Reply Box 508, Modern Plastics.

WANTED—Lucite or plexiglas sheets and/or off cuts urgently required, any thickness, any quantity, bought for cash, also scrap lucite or plexiglas, any quantity in carload lots. L & S Plastics Supply Co., 809-11 6th Avenue, New York 1, N. Y.

PLEXIGLAS and LUCITE SCRAP WANTED. Interested in small and large quantities of clean, irregular-shaped flat pieces, strips, rods and other cut-offs. All thicknesses; masked and unmasked. Kindly describe fully, stating quantity available. Box 1210, Modern Plastics.

Do you need a Hydraulic Press for Compression Molding, Transfer Molding, Laminating, Forming, Bending and Hobbing? Whatever it may be, if it is hydraulic, see

Sal-Press Company,
388 Warren Street,
Brooklyn, N. Y.

Specializing in rebuilding of new, and used hydraulic equipment.

Argentine Representation—Established Argentine Concern seeks representation in Republic of Argentina for manufacturers of Celluloid and other Cellulose Plastics. Satisfactory references. Address Andrew Lustig, The Casilla de Correo 728 and 729, Buenos Aires.

NEED DISTRIBUTION OF YOUR PRODUCT?

Sales Engineers with a result record can use another item of merit. References exchanged. What have YOU to offer? Write fully.

P.O. Box 1007, St. Louis, Mo.

FOR SALE: Hydraulic Presses 600 ton Watson Stillman downward double acting ram, platen 24" x 24", 1—36" x 36" 12" ram, 200 ton all steel construction, 8—20" x 20" 10" rams, 1—24" x 24" 12" ram, 1—52" x 26" 14" ram 400 tons, 4—12" x 12" 7½" rams, 3—12" x 12" 8" rams, 1—32" x 50" 15" ram, 4 openings, 1—26" x 45" 10" ram, 2—15" x 15" 8½" rams, 4 Hanna Hydraulic Cylinders, Model HP 14, 30 ton capacity, 8" dia. 36" stroke. PUMPS: Robertson Triplex 5 GPM 5000 lbs., Watson Stillman 4 plunger box type 2 GPM 4000 lbs., Deane Triplex 4 GPM 2500 lbs., HMP Triplex 1½ GPM 2500 lbs., Gould Triplex 12 GPM 1250 lbs., 4 plunger vertical 4 GPM 2250 lbs., National Triplex 3 GPM 4000 lbs., Hele Shaw JLP 12, 44 GPM 1200 lbs., HPM Triplex 1½ GPM 2000 lbs., on high, 16 GPM 400 lbs., on low, V Belt Drive, ACCUMULATORS: Hydro-Pneumatic 4½" dia. plunger by 27" stroke with By-Pass Valve, Weighted type 5" dia. by 6" stroke. EXTRUDERS: No. 2 Royle Perfected; Mills, Calenders, Mixers, etc. Advise your requirements. HIGHEST PRICES PAID FOR YOUR USED EQUIPMENT. Universal Hydraulic Machinery Company, 285 Hudson Street, New York City 13.

FOR SALE—large quantities of Black Saran Scrap and Brown Polythene Scrap. Reply Box No. 1322, Modern Plastics.

GENERAL MANAGER. Plastics, age not a prime factor but 35-38 years preferred; American, business executive ability with experience; general knowledge of accounting and costs; honest, ambitious and capable; pleasing personality combined with personal neatness; knowledge of engineering; mechanical and creative ability combined with ingenuity and initiative; ability to establish and maintain intelligent and congenial business contacts and relationships with all customers; in short a thorough "go-getter." Remuneration—salary plus commission. Apply at once to Greene Plastics, Wakefield, R. I., giving full qualifications, experience and references.

Master Mechanic—Top salary will be paid to man with proven ability and wide experience with plastic molds; mold duplication by electro-plating casting or other methods except hobbing. Product design experience unnecessary. Duties include perfecting present methods of mold fitting and instructing other mechanics. Single product multiple small shapes and sizes, large volume. No estimating, record-keeping or other details. Old established Pennsylvania corporation. Steady work now and postwar. In reply state age, experience, salary, etc. Reply box number 1312, Modern Plastics.

Distributor—with a sales force and organization now calling on home owners in and around Pittsburgh on Storm Sash, Roofing, Weatherstripping, etc., wishes Distribution of Kindred Items or what have you? Reply Box 1314, Modern Plastics.

Mexican firm with sound financial backing interested in representing American manufacturing of Plastic items on exclusive basis. Cordoba Gomez y Urrea, Amsterdam 250, Mexico, D. F., Mexico.

Plastics Engineer, college graduate, 30 yrs. age, currently practicing profession in Navy, desires to contact firm interested in his services after war. Associated with plastics industry 6½ years, including sales engineering, research and development work in molding materials, low pressure laminates, and formed acrylics. Details upon request. Reply Box 1311 Modern Plastics.

Production Manager Wanted for injection and compression plastic factory located in Ohio. One experienced in decorative plastic production preferred. State experience and references. Excellent opportunity to right party. Reply Box 1316, Modern Plastics.

Established sales representative with engineering background maintaining Philadelphia office and covering Eastern Pennsylvania, Southern New Jersey, Delaware, and Maryland, desires to represent reliable custom molder of thermosetting and thermoplastic materials. Should have compression capacity up to 400 ton. Have excellent contacts with engineering and purchasing departments of manufacturers in leading industries. Reply Box 1317, Modern Plastics.

(Designer)
and
(Samplemaker)
(in Plastics)

excellent opportunity. Imagination and ingenuity an asset; splendid post war.

Write full particulars. Box 648 Real-service, 110 West 34th.

BRAND NEW PLASTIC PRODUCT. Household item. Sell through hardware, furniture and variety stores. Retail about 10c.

If you have manufacturing and distributive facilities let me hear from you. Royalty or outright sale.

Everett M. Roberson, 215 Pine Street, Peoria, Illinois.

Large Canadian importer and distributor located in Montreal, with nation wide coverage desires additional lines in housewares, glass, china and plastics for direct representation and/or exclusive distribution in Canada. Satisfactory references may be had on reply to Box 1318, Modern Plastics.

FOR SALE: Farrel Birm., 150 ton Mold Presses, also 25 to 250 tons; 36" x 36", 30" x 40", 16" x 16", 12" x 12", 33" x 35", 24" x 33", 49 ton Broaching Press; 400 ton Extrus. Pr.; W. S. Hor. 4 plgr., 1" & 2" x 4", H & L pressure pump; W. S. 1—½" x 12" hor. 4 plgr. 30 GPM, 3500 lbs., H.F.M. 1½" x 6", vert. Triplex, 10 GPM, 2700 lbs.; 2-Oilgear Pumps, 13 GPM 1250 lbs.; Wat.-Farrel 1½" x 4", vert. triplex, 6 GPM, 3000 lbs.; Goulds 2½" x 8" vert. triplex 30 GPM, 1600 lbs.; Elmes 1" x 4" & 1½" x 4" hor. 4 plgr., 5 to 8 GPM, 4500 lbs. & 3500 lbs. Rumsey 4½" x 8" vert. triplex, 65 GPM, 900 lbs.; Elmes 2½" x 4" hor. 2 plgr., 17 GPM, 850 lbs.; 10 HP horis. 1½" x 4" triplex 6 GPM, 3000 lbs.; New Vickers Oil Pumps, 20 GPM, 1000 lbs.; New Vickers 1½" Oil Relief Valves; New Vickers ½" Flow Control Valves; Hydr. Steam Pumps; Hand Pumps; Low Pressure Pumps 150 to 600 lbs.; Hydr. Accum., ½", ¾" and 1" Preform Tablet Mach.; Heavy Duty Mixers; Roller Conveyor, Grinders, Pulverizers, Gas Boilers, etc. PARTIAL LISTING. We BUY YOUR USED MACHINERY. STEIN EQUIPMENT CO., 426 BROOME ST., NEW YORK 13, N. Y. CANAL 6-8147.

FOR SALE: Stokes DS3 Rotary Pelleting Machine; 6" x 13" Two Roll Mixing Mill; 10" x 28" Mixing Mill; 100 gal. W. & P. Jacketed Mixer sigma blades. BRILL EQUIPMENT COMPANY, 225 W. 34th Street, New York 1, N. Y.

INDUSTRIAL DESIGNER wanted. Must be topnotch. Rendering, styling, successful product experience important, plus ability to meet clients and handle accounts. Excellent permanent future, high salary. Write or visit our office nearest you.

J. GORDON LIPPINCOTT & CO.

500 Fifth Avenue, New York City.
230 North Michigan Avenue, Chicago.

WANTED: Development Engineer or Chemist for research and development work on plastic and resin compounding and processing. Prefer young man with ability, experience not too essential. Location—middle west. State full particulars as to qualifications and salary desired. Reply Box 1319, Modern Plastics.

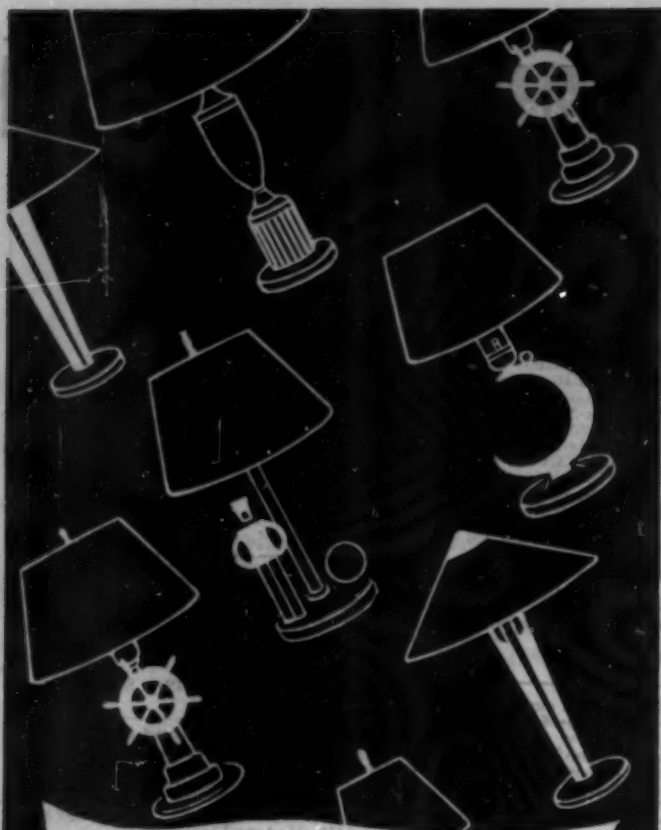
RAZOR DESIGNER

Large nationally known manufacturer seeks services of man with experience in design of safety razors. Salary open, but will be made attractive to the right man. Reply Box 1320, Modern Plastics.

CIGARETTE LIGHTER DESIGNER

Large nationally known manufacturer seeks services of man with experience in design of cigarette lighters. Salary open, but will be made attractive to the right man. Reply Box 1321, Modern Plastics.

For sale—20,000 lbs. of reground and reworked Black Acrylic Molding Powder. Make offer. Box Number 1313.



HIGH LIGHTS OF FABRICATION

Many a lamp has attained unusual charm and popularity because of a well turned base, or upright or even a filial, which we have fabricated from cast resins. These will be on our first peace time production schedules when our war jobs terminate. Meanwhile, fluted base columns, winged uprights, ship's wheels, and decorative miniature figures, to which plastics fabrication can give full expression, are topics of present conversation between lamp manufacturers and ourselves. Perhaps these fabricated parts will offer a suggestion to your plans.



We specialize in the custom fabrication of plastic parts of every description: Catalin, Acrylics, Polystyrene, Cellulose, Acetate, Laminates.

PLASTIC
Turning Co. Inc.
LEOMINSTER, MASS.



We are now in full production on various types of products for the aircraft industry, employing the Winner Process which enables us to maintain exact temperatures while varying pressures from 10 to well over 100 lbs. psi.

Although some sections of a product contain twice the number of material layers as other sections, our pressure control makes it possible to cure ALL parts perfectly.

Phenols, resorcin resins, styrenes, melamines, etc., are used in manufacturing low pressure laminate parts in combination with cotton duck, glass cloth, impregnated papers, rope fibres and other materials. In addition to our work with fluid pressure, we are also making pieces using various types of contact resins.

We invite your inquiry regarding products of any shape or size.

PLASTICS WINNER PLASTICS

DIVISION OF WINNER MFG. CO., INC.
200 Railroad Ave. West Trenton, N. J.

Specify **ARO** PNEUMATIC TOOLS

ARO model 101 with plastic
housing and handle—weighs
only 1 lb. 9 ounces—operates a
full 1/4-inch drill.

Then...

BRING ON YOUR TOUGH JOBS

● Engineered to furnish *more power* than average tools of their size... ARO Pneumatic Tools get *more work done* with less fatigue!

Today—ARO Tools in war production are speeding up drilling, nut-setting, screw-driving, grinding and countless other small tool jobs. In reconversion—ARO Tools will gear industry to greater efficiency and faster output of peace-time products. Simple in design... rugged...dependable...stall-proof. Write for new catalog No. 44.

The Aro Equipment Corporation, Bryan, Ohio.



MODERN PLASTICS

There is no other organization
like this in *Plastics*



THE Swedlow Plastics Division of Shellmar Products Company is unique in the plastics industry. Equally famous for beautiful designs and smart industrial applications, the original Swedlow organization has been much expanded in combination with one of America's important concerns, Shellmar Products Company. Several of plastics' outstanding engineering personalities have been added to the staff. The organization's financial structure has been considerably expanded, new plant facilities are being added. A number of new materials and new applications have been developed. These will be announced from time to time in our advertisements in MODERN PLASTICS Magazine.

Meanwhile, the expanded Swedlow Plastics Division of Shellmar is anxious to serve you.

We specialize in large, low pressure molded structures manufactured of unique combinations of materials to meet specific requirements.



SWEDLOW *Plastics Division*

SHELLMAR *Products Co.*

PLANTS: MT. VERNON, OHIO
MEXICO CITY • GLENDALE
PASADENA • SOUTHGATE, CAL.

SALES OFFICES: NEW YORK Empire State Bldg.
GLENDALE, CAL.
DETROIT and Principal Cities



"What the well dressed shaving stick is wearing"

Williams Shaving stick steps out in gleaming red jacket and attractive white cap — custom injection moulded by the Trio — a holder to suit any man's taste.

This container comes from a long line of successful Worcester Moulded plastics applications. Most of them have started from scratch, even from an initial discussion about the advisability of using plastics in any form. The results of an approach like this run strongly in your favor. You automatically draw our wholehearted attention to your problem because we mould for customers exclusively. You immediately call upon every phase of die design, engineering, requisite qualities of raw materials, moulding

techniques and finishing — upon adequate, precious experience in volume production and delivery, or slower intricate operations — and upon facilities in every department which are ample to meet your particular demands.

If you can find a minute to make such an approach, not only will you be welcomed, but you will be following in many nationally known footsteps.



Custom Injection Moulding

WORCESTER MOULDED PLASTICS CO.

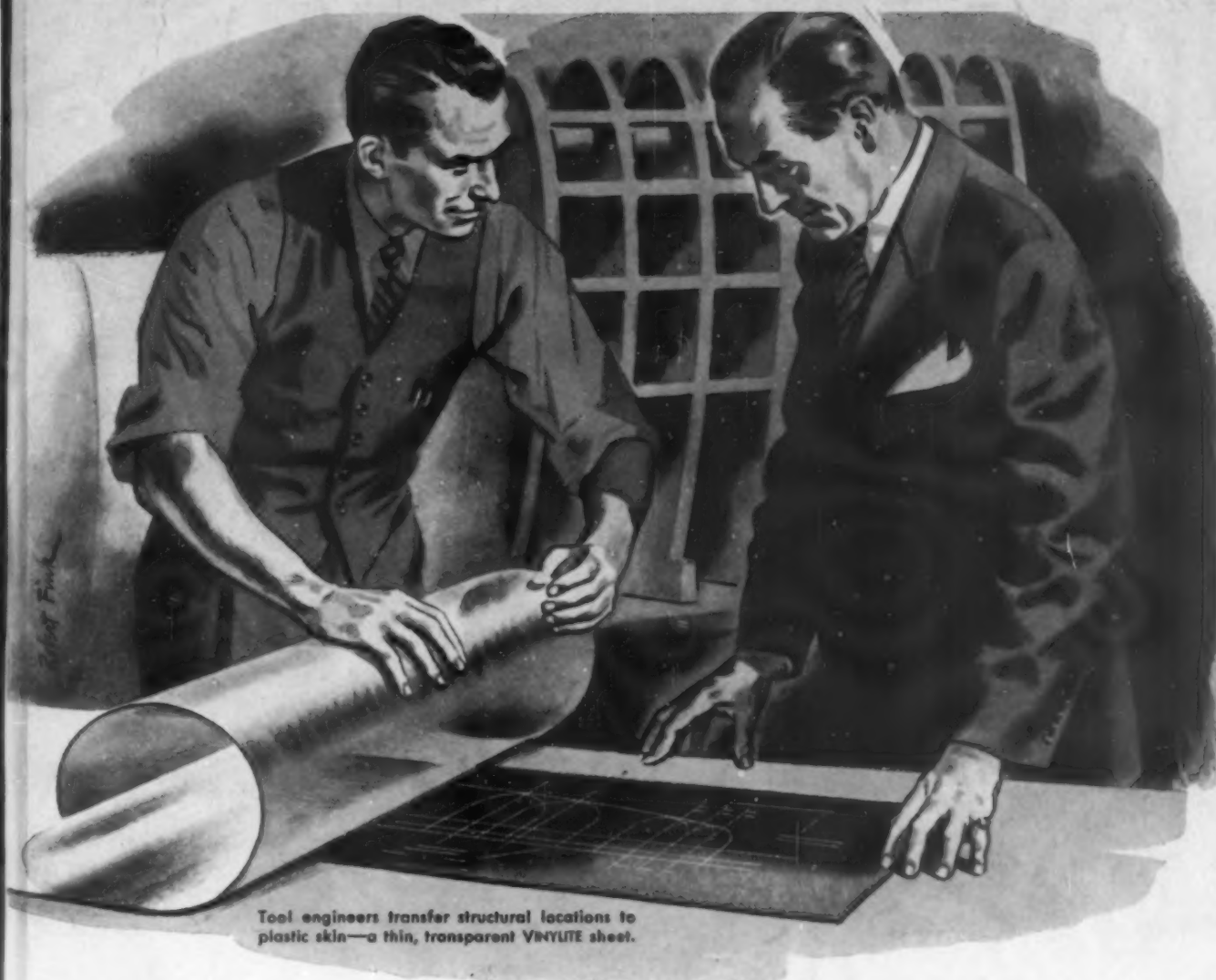
14 HYGEIA STREET, WORCESTER 8, MASS.

17 East 42nd St., New York 17, N. Y.

Expert Office: 90 Broad St., New York 4, N. Y.

DIMENS
of it!
VINYL
for tem
terial is
ties, and
in sever
they sc
or tran
sprayed
printer
ferred t
—steel,
etc., pr
tive em
quickly
ting and

V



Tool engineers transfer structural locations to plastic skin—a thin, transparent VINYLITE sheet.

TEMPLATES ARE MADE FASTER TODAY

DIMENSIONAL STABILITY — and lots of it! That's one asset that makes VINYLITE plastic rigid sheets ideal for templates. But this unique material is packed with useful properties, and helps speed templet making in several ways. At one large plant they scribe layouts on transparent or translucent sheets through a sprayed-on opaque film. In a contact printer the layout is then transferred to the material to be marked — steel, aluminum, wood, or cloth, etc., pre-treated with a light-sensitive emulsion. The "print" is then quickly developed and ready for cutting and filing.

Another plant profits from the ease with which VINYLITE plastic rigid sheets can be pencilled and inked. The material has proved a big help in the development of leading-edge templates for airplane wings. A complete covering of three separate "skins" is used so that when the mock-up skin is properly fitted on the basis of the rib structure, as seen through the skin, axes for inspection holes and machine gun cut-outs can be transferred directly from the rib structure.

VINYLITE plastic rigid sheets are supplied in a range of thicknesses.

Their properties include, besides dimensional stability, high degrees of resistance to moisture, abrasion, and practically all chemicals. Write Department 7-H today for Booklet S-1, "VINYLITE Plastic Rigid Sheets." It may show how you can effect economies and product improvements by the use of this versatile material.

BAKELITE CORPORATION

Unit of

Union Carbide and Carbon Corporation

UCC

30 EAST 42ND ST., NEW YORK 17, N. Y.

Vinylite Plastics

TRADE-MARK

DESIGNED AND ENGINEERED AT NO. 1 PLASTICS AVENUE

PROBLEM: ① TO DESIGN A MORTAR FUSE
② MUST ELIMINATE ALL
MACHINING OPERATIONS



FAMOUS PLASTIC M-52 MORTAR SHELL FUSE—Left: Transparent instruction model shows intricate hole pattern in colors. Right: Three stages of assembly

FUSES BY THE MILLIONS—THANKS TO PLASTICS

● The M-52 fuse is the business end of every mortar shell. Our Infantry needed M-52's by the millions—and there was a shortage of aluminum. Could plastics provide the answer?

They could—and did. No. 1 Plastics Avenue tackled the problem . . . designed this mold of Chinese-puzzle complexity . . . made 105 sets of molds precisely alike . . . engineered a whole new transfer molding technique—from development of new raw materials to final inspection of finished product . . . an impossible job until then.

Then, by improving processes and machinery, General Electric went on to double production from the original molds—to over a million a month. And every plastic mortar shell fuse saves a pound of bar stock aluminum and hours of machine operations.

Why not use many such wartime plastics experiences to plan better post-war products? Available to all industry is General Electric's complete plastics service. Bring your plastics problem to G.E.—the world's largest manufacturer of plastics parts. Write to Plastics Divisions, General Electric Company, 1 Plastics Avenue, Pittsfield, Mass.

G-E Complete Service—Everything in Plastics

Backed by 51 years of experience, General Electric has been designing and manufacturing plastic products ever since 1894.

G-E Design and Engineering Service. Our own industrial designers and engineers work together. Result: plastics parts that are both scientifically sound and good-looking.

G-E Mold Service. Fully equipped toolrooms are manned by skilled craftsmen whose average precision mold experience is 12 years. G-E molds are chromium-plated for longer life.

G-E Quality Control. Our plastic products may pass through as many as 160 inspections and analyses. Army-Navy rejections are so low as to be negligible at General Electric.

G-E Research works continually to develop new materials, new processes, new applications for plastics.

G-E Manufacturing Facilities are available for all types of plastic parts—for compression molding, injection molding, transfer molding, extrusion molding, cold molding, both high and low pressure laminating, and fabricating.



BUY WAR BONDS
AND HOLD THEM

GENERAL ELECTRIC
CHAS. A. S.

Hear the General Electric radio programs: "The G-E All-Girl Orchestra" Sunday 10 P.M. EWT, NBC. "The World Today" news every weekday 6:45 P.M. EWT, CBS. "G-E House Party" every weekday 4:00 P.M. EWT, CBS.